



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY

LYNDO TIPPETT

GOVERNOR

SECRETARY

May 11, 2004

Mr. Eric Alsmeyer
U.S. Army Corps of Engineers
Regulatory Field Office
6508 Falls of the Neuse Road, Suite 120
Raleigh, North Carolina 27615

Dear Mr. Alsmeyer:

SUBJECT: Application for Section 404 Individual Permit and Section 401 Major Water Quality Certification for the Proposed Replacement of Bridge Nos. 74 and 76 and Interchange Improvements Over SR 1242 and Michael Branch.
Davidson County; Federal Aid No. BRSTP-29(10); State Project No. 8.1601401; TIP No. B-3157; \$475.00 Debit work order 8.1601401, WBS Element 32899.1.1

This application addresses project B-3157 and consists of the cover letter, ENG Form 4345, permit drawings, half-size plan sheets, utility permit drawings and plan sheets, Revised Categorical Exclusion, draft minutes from the interagency permit drawing review meeting and stream relocation/restoration design information.

Project Description:

The North Carolina Department of Transportation (NCDOT) proposes to replace Bridge Nos. 74 and 76 in their existing locations and improve the interchange at US 29-64-70 and I-85 Bus. in Lexington, Davidson County, North Carolina. Proposed improvements include the following:

- a two-barrel reinforced box culvert to replace two 78-inch corrugated metal pipes to carry Michael Branch under SR 1242 (West Center Street Extension) and US 29-64-70/I-85 Bus.
- the relocation/ restoration of Michael Branch
- an addition of 12 feet of paved surface to US 29-64-70/I-85 Bus. to allow for an auxiliary lane
- widening of SR 1242 to a three-lane, curb-and-gutter section from south of SR 1292 to north of SR 1401

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS
1548 MAIL SERVICE CENTER
RALEIGH NC 27699-1548

TELEPHONE: 919-733-3141
FAX: 919-733-9794

WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
TRANSPORTATION BUILDING
1 SOUTH WILMINGTON STREET
RALEIGH NC

- the relocation of the intersection of Swing Dairy Road and SR 1242 to opposite SR 1401
- an acceleration lane for the existing southwest ramp onto US 29-64-70/I-85 Bus. Northbound
- a deceleration lane for US 29-64-70/I-85 Bus. southbound to SR 1401.

The proposed improvements will cause the relocation/construction of water and sewer lines within the project study area.

Purpose and Need:

Bridge Maintenance Unit records indicate Bridge No. 74 and Bridge No. 76 have sufficiency ratings of 40.1 and 42.1, respectfully, out of a possible 100 for a new structure. The bridges are considered to be structurally deficient. The replacement of these inadequate structures and improvements to the interchange will result in safer traffic operations by providing acceleration and deceleration lanes and by addressing the operational aspects of the current traffic pattern.

Summary of Impacts:

WATERS OF THE UNITED STATES

B-3157 will permanently impact 876 linear feet (0.19 acres) of jurisdictional stream through the construction of the proposed bridge. The stream impact will be to two perennial streams, Michael Branch and Erlanger Branch. Utility relocations will temporarily impact 19 feet of jurisdictional stream. Impacts to Michael Branch due to the onsite stream mitigation are 484 ft. There are no wetlands or ponds within the project area.

BRIDGE DEMOLITION AND REMOVAL

In order to protect the water quality and aquatic life in the area affected by this project, the NCDOT will follow the *Best Management Practices for Bridge Demolition and Removal*. Best Management Practices (BMPs) followed for bridge demolition and removal are in addition to those implemented in accord with NCDOT *Best Management Practices for Protection of Surface Waters*.

Dropping any portion of the structures into waters of the United States should be avoided unless there is no other practical method of removal. In the event that no other practical method is feasible, a worst-case scenario is assumed for calculations of fill entering waters of the United States. The existing bridges both have concrete decks with steel beams and concrete bent caps on steel piles. There is potential for components of the superstructures of the bridges to be dropped into waters of the United States. The maximum resulting temporary fill calculated is seven cubic yards for Bridge No. 74 and six cubic yards for Bridge No. 76.

The stream substrate in the project area is sandy with some clay and cobbles. Due to the potential sedimentation concerns resulting from demolition of the bridges, a turbidity curtain is recommended to contain and minimize sedimentation in the stream where it is possible to do so.

Under the guidelines presented in *Best Management Practices for Bridge Demolition and Removal*, work done in the water for this project would fall under Case 3, which states that there

are no special restrictions other than those outlined in NCDOT *Best Management Practices for Protection of Surface Waters*. This conclusion is based upon the classification of the waters within the project area and vicinity, as well as comments received during the reporting process from the North Carolina Wildlife Resources Commission (NCWRC).

Summary of Mitigation:

Throughout the National Environmental Policy Act (NEPA) and design processes, the project has been designed to avoid and minimize impacts to jurisdictional areas. Detailed descriptions of these actions are presented in the Mitigation Options section of this application.

Compensatory mitigation for the remaining 876 ft of stream impacts consists of 950 linear feet of on-site stream relocation using natural channel design techniques at Michael Branch. The 484 ft of stream impacts due to the onsite mitigation do not require further mitigation.

Project Schedule:

Replacement of Bridge Nos. 74 and 76 and improvements to the US 29-64-70/I-85 Bus. interchange will be let to construction on September 21, 2004, with an availability date of October 26, 2004.

NEPA Document Status:

The first Categorical Exclusion (CE) was approved on July 25, 2000. However, due to proposed impacts to a city park, which required a programmatic Section 4(f) evaluation and the addition of another alternative, a revised CE was written. The programmatic Section 4(f) evaluation was needed because approximately 0.2 acres of Childers Park, a City of Lexington property, would be impacted by this project. The Revised CE and Programmatic Section 4(f) Evaluation were approved on November 22, 2002.

Indirect and Cumulative Impacts:

This project consists of replacing a deficient structure. Capacity, traffic patterns, and access improvements are not a part of the project's scope of work. Thus, changes in the patterns of development and/or land uses in the vicinity of the bridge project would not be anticipated to stem from the bridges' replacement. This type of project is not anticipated to alter the existing land uses or increase accessibility to adjacent parcels. Thus, an indirect and cumulative impacts study is not needed.

Independent Utility:

This project is in compliance with 23 CFR 771.111(f), which lists the Federal Highway Administration (FHWA) characteristics of independent utility of a project:

- (1) The project connects logical termini and is of sufficient length to address environmental matters on a broad scope;
- (2) The project is usable and a reasonable expenditure even if no additional transportation improvements are made in the area; and
- (3) The project does not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.

Resource Status:

DELINEATIONS

Delineations of jurisdictional surface waters were completed by Ramey Kemp and Associates, Inc. on September 2, 1998. Additional field investigations were performed by Ramey Kemp and Associates, Inc. on March 28, 2000, and June 11, 2002, due to an expanded study area. Streams being impacted by this project are perennial, therefore no verifications were needed. There are no wetlands within the project area.

WATERS OF THE UNITED STATES

Michael Branch (DWQ index # 12-113-3) and Erlanger Branch fall within the Yadkin River Basin, Subbasin 03-07-07 and USGS Subbasin 03040103. They are designated class “C” waters by the North Carolina Department of Environment and Natural Resources. A class “C” designation indicates the waters’ suitability for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture. Neither stream is classified as a Wild and Scenic River. There are no streams within 1.0 mile from the project on the 303(d) list of impaired waterways for North Carolina.

Table 1 lists the jurisdictional stream impacts of B-3157. The project will permanently impact 876 linear feet (0.19 acres) of jurisdictional stream channels. The impacts consist of an extension of a 10-foot by 10-foot culvert on Michael Branch under US 64/SR 1243 (Site No. 1, Station 20 + 81.5 at Y6), a two-barrel reinforced concrete box culvert, 12 feet by 9 feet, for Michael Branch under SR 1242 and US 29-64-70/I-85 Bus. (Site No. 1, Station 17 + 48 at Y1), and the extension of Erlanger Branch to intersect with Michael Branch (Site No. 2, Station 12 + 05 at Y2). Mitigation is required for these impacts.

Table 1: Impacts to Jurisdictional Streams from B-3157

Site	Station	Stream	structure	Feet of Impact (ft)	Area of Impact (ac)
1	20+81.5-Y6	Michael Branch	1@ 10 ft X 10 ft RCBC, & 72 in smooth steel	114 ft	0.02 ac
1	17+48-Y1	Michael Branch	2@ 12 ft X9 ft RCBC	743	0.17 ac
2	12+05-Y2	Erlanger Branch	60 in RCP	19 ft	<0.01 ac
TOTAL				876 feet	0.19 acres

Impacts to Michael Branch from the onsite stream relocation are 484 ft. No mitigation is required for these impacts.

Protected Species:

Plants and animals with Federal classifications of endangered (E) or threatened (T) are protected under provisions of Section 7 of the Endangered Species Act of 1973, as amended. Collection and interstate and international commercial trade of plants and animals with federal classification of threatened due to similarity of appearance [T(S/A)] is banned. As of January 29, 2003, the United States Fish and Wildlife Service (USFWS) has listed three federally protected species for Davidson County. Table 2 outlines these species.

Table 2. Federally Protected Species Listed in Davidson County

Common Name	Scientific Name	Status	Biological Conclusion
Bald eagle	<i>Haliaeetus leucocephalus</i>	T (proposed for delisting)	No Effect
Bog turtle	<i>Clemmys muhlenbergii</i>	T (S/A)	N/A
Schweinitz's sunflower	<i>Helianthus schweinitzii</i>	E	No Effect

Endangered (E) is defined as a taxon in danger of extinction throughout all or a significant portion of its range.

Threatened (T) denotes a taxon likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Threatened due to Similarity of Appearance [T(S/A)]

The potential effects of B-3157 on federally protected species listed in Table 2 have been investigated. The bog turtle is a species that is threatened due to similarity of appearance with another rare species and is listed for its protection; however, the bog turtle is not biologically endangered or threatened and is not subject to Section 7 consultation. The Revised CE provides a biological conclusion of No Effect for the bald eagle and Schweinitz's sunflower. No habitat was deemed available for the bald eagle in the project study area. Habitat was located for Schweinitz's sunflower in project study area; however, surveys by RK & K biologists on September 2, 1998, and March 28, 2000, found no specimens of this species. Additional surveys were conducted by NCDOT biologists on May 3, 2004. Areas in the right-of-ways showed evidence of mowing and regular maintenance, only marginal habitat is present within the project area. This species is not flowering at the time of the May 3 survey, but no species of *Helianthus* were found within the project area, therefore we believe this project will have "No Effect" on Schweinitz's sunflower.

A review of the North Carolina Natural Heritage Program (NCNHP) records on March 22, 2004, revealed that there were no known populations of federally protected species or federal species of concern (FSC) within 1.0 mile of the proposed project area.

Cultural Resources:

ARCHITECTURAL RESOURCES

A field survey of the Area of Potential Effects (APE) was conducted on August 6, 1998. All structures within the APE were photographed and later reviewed by the North Carolina State Historic Preservation Office (SHPO). In a concurrence form dated December 30, 1998, and a memorandum dated November 20, 1998, SHPO concurred that there are no historic architectural resources within the APE either listed on or eligible for the National Register of Historic Places. A copy of the concurrence form and the memorandum are found in the CE document.

ARCHAEOLOGICAL RESOURCES

SHPO in a memorandum dated November 20, 1998, recommended that “no archaeological investigation be conducted in connection with this project.” During the project development, the study area expanded, but SHPO, in a memorandum dated October 8, 2002, had no comment on the undertaking proposed. A copy of the SHPO memorandums are found in CE document.

Utility Impacts:

The construction of the proposed project will cause the relocation of utility lines. The following paragraphs describe these impacts:

- 1) Plan sheet UC-2: The proposed construction of Sewer Line 1 will cross Michael Branch to the right of Y1, at approximate station 22 + 73. This will result in approximately 5 feet of temporary channel impact.
- 2) Plan sheet UC-3: The proposed construction of Sewer Line 2 will cross Michael Branch to the left of Y2, at approximate station 14 + 45. This will result in approximately 4 feet of temporary channel impacts.
- 3) Plan sheet UC-3: The proposed construction of Sewer Line 4 and a water line will cross Erlanger Branch to the right of Y2, at approximate station 12 + 05. This will result in approximately 6 feet of temporary channel impacts.
- 4) Plan sheet UC-3: The proposed construction of a water line will cross Michael Branch to the left of Y1, at approximate station 17 + 77. This will result in approximately 4 feet of temporary channel impacts.

FEMA Compliance:

The project site on Michael Branch and Erlanger Branch was included in a detailed Federal Emergency Management Agency (FEMA) Flood Study. However, the project site does not have an established floodway. The proposed replacement will not adversely affect the existing flood plain or modify flow characteristics.

Mitigation Options:

The US Army Corps of Engineers (USACE) has adopted, through the Council on Environmental Quality (CEQ), a wetland mitigation policy that embraces the concept of “no net loss of wetlands” and sequencing. The purpose of this policy is to restore and maintain the chemical, biological, and physical integrity of the waters of the United States. CEQ has defined mitigation of wetland and surface-water impacts to include: avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time, and compensating for impacts (40 CFR 1508.20). For this project, mitigation is only required for impacts associated with jurisdictional streams. No jurisdictional wetlands will be impacted by this project.

The NCDOT is committed to incorporating all reasonable and practicable design features to avoid and minimize jurisdictional impacts and to providing full compensatory mitigation of all remaining, unavoidable jurisdictional impacts. Avoidance measures were taken during the planning and NEPA compliance stages; minimization measures were incorporated as part of the project design.

AVOIDANCE:

Impacts to Michael Branch and Erlanger Branch cannot be avoided, except by choosing a no-build alternative.

MINIMIZATION:

The following project-specific measures were or will be employed by NCDOT to minimize impacts to waters of the United States during construction of this project:

- Best Management Practices will strictly be enforced for sediment and erosion control for the protection of surface waters and wetlands.
- Best Management Practices will strictly be enforced for bridge demolition and removal.

The following site-specific measures were employed by NCDOT to minimize impacts to waters of the United States during the design of this project:

- Extending the culvert on Michael Branch: other options would have filled in the stream.
- Under the -L- line (Station -L-28+75), the culvert will be buried 1 foot in one barrel and 2 feet in the other to accommodate low flow and allow for aquatic movement.
- Relocating Michael Branch using natural channel design.
- Along Ramp C, one energy dissipator and three preformed scour holes will be installed to minimize the impacts on water quality.
- Along -L-(near Station 28+00), a preformed scour hole will be installed to minimize the impacts on water quality.

COMPENSATION:

The primary emphasis of the compensatory mitigation is to reestablish a condition that would have existed if the project were not built. As previously stated, mitigation is limited to reasonable expenditures and practicable considerations related to highway operation. Compensatory actions often include restoration, creation, and enhancement of waters of the United States.

FHWA Step Down Compliance:

All compensatory mitigation must be in compliance with 23 CFR 777.9, "Mitigation of Impacts," which describes the actions that should be followed to qualify for Federal-aid highway funding. This process is known as the FHWA "Step Down" procedures:

1. Consideration must be given to mitigation within the right-of-way and should include the enhancement of existing wetlands and the creation of new wetlands in the highway median, borrow pit areas, interchange areas, and along the roadside.
2. Where mitigation within the right-of-way does not fully offset wetland losses, compensatory mitigation may be conducted outside the right-of-way, including enhancement, creation, and preservation.

Compensation:

B-3157 will permanently impact 876 linear feet of jurisdictional streams (Michael Branch and Erlanger Branch) that comprise waters of the United States. On-site stream relocation using natural channel design techniques will be utilized on 950 linear feet of Michael Branch in order to mitigate for the permanent impacts. A field review meeting for the Stream Relocation/Restoration Design was held on August 13, 2003. Michael Branch has been degraded due to heavy urbanization surrounding the stream. The existing stream channel is incised, displays excessive bank erosion, and has extremely undercut banks caused by the channel widening itself to develop pattern. In order to stabilize the stream channel, the flood-prone width will be increased, grade-control structures will be installed, and vegetation will be planted. Since we are improving the existing stream, NCDOT proposes 1:1 mitigation credit for all stream-restoration efforts. A copy of the Natural Channel Design Summary for Michael's Branch and Reforestation Sheet is attached to this application.

Environmental Agency Review


An environmental agency review was conducted for the permit drawings for B-3157 on October 23, 2003. The draft minutes from the review meeting are attached to this application.

Regulatory Approvals

Application is hereby made for a USACE Individual Section 404 Permit as required for the above-described activities. We are also hereby requesting a 401 Water Quality Certification from the North Carolina Division of Water Quality (NCDWQ). In compliance with Section 143-215.3D(e) of the NCAC we will provide \$475.00 to act as payment for processing the Section 401 permit application previously noted in this application (see Subject line). We are providing seven copies of this application to the NCDWQ for their review.

If you have any questions, or need additional information, please contact Ms. Rachelle Beauregard at (919) 715-1383.

Sincerely,


Gregory J. Thorpe, Ph.D, Manager
Project Development and Environmental Analysis Branch

cc:

Mr. John Hennessy, NCDWQ (7 copies)
Ms. Marla Chambers, NCWRC
Ms. Becky Fox, USEPA – Whittier, NC
Mr. Ronald Mikulak, USEPA – Atlanta, GA
Ms. Marella Buncick, USFWS
Mr. John F. Sullivan, III, P.E., FHWA
Mr. Jay Bennett, P.E., Roadway Design
Mr. Omar Sultan, Programming and TIP
Mr. Art McMillan, P.E., Highway Design
Mr. David Chang, P.E., Hydraulics
Mr. Greg Perfetti, P.E., Structure Design
Mr. Mark Staley, Roadside Environmental
Ms. Stacy Baldwin, PDEA Project Planning Engineer
Mr. S. P. Ivey, P.E., Division 9 Engineer
Ms. Diane Hampton, P.E., Division 9 DEO
Mr. David Franklin, USACE, Wilmington (Cover Letter Only)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT
(33 CFR 325)

OMB APPROVAL NO. 0710-0003
Expires December 31, 2004

The Public burden for this collection of information is estimated to average 10 hours per response, although the majority of applications should require 5 hours or less. This includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please **DO NOT RETURN** your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research and Sanctuaries Act, 33 USC 1413, Section 103. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED
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(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME North Carolina Department of Transportation	8. AUTHORIZED AGENT'S NAME AND TITLE (an agent is not required)
6. APPLICANT'S ADDRESS Parker Lincoln Building 2728-168 Capital Blvd. Raleigh, NC 27604	9. AGENT'S ADDRESS
7. APPLICANT'S PHONE NOS. W/AREA CODE a. Residence N/A b. Business 919-715-1383	10. AGENT'S PHONE NOS. W/AREA CODE a. Residence b. Business

11. STATEMENT OF AUTHORIZATION

I hereby authorize, _____ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE _____

DATE _____

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions) US 29-64-70 and I-85 Business Replace Bridge Nos. 74 and 76 and Interchange Improvements	
13. NAME OF WATERBODY, IF KNOWN (if applicable) Michael Branch and Erlanger Branch	14. PROJECT STREET ADDRESS (if applicable)
15. LOCATION OF PROJECT Davidson County North Carolina COUNTY STATE	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN, (see instructions)

17. DIRECTIONS TO THE SITE

From Raleigh, take I-40 West to I-85 South to US 64 West. The site is located where US 64 West diverges from US 29-70 and I-85 Business.

18. Nature of Activity (Description of project, include all features)

See attached sheet.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

See attached sheet.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

See attached sheet.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

Discharged material will consist of fill dirt and riprap, as described in the attached permit application.

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

See attached sheet.

23. Is Any Portion of the Work Already Complete? Yes ☐ No ☒ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

See attached sheet.

25. List of Other Certifications or Approvals/Denials Received from other Federal, State or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

*Would include but is not restricted to zoning, building and flood plain permits

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

Rebecca E.
SIGNATURE OF APPLICANT

4/27/04
DATE

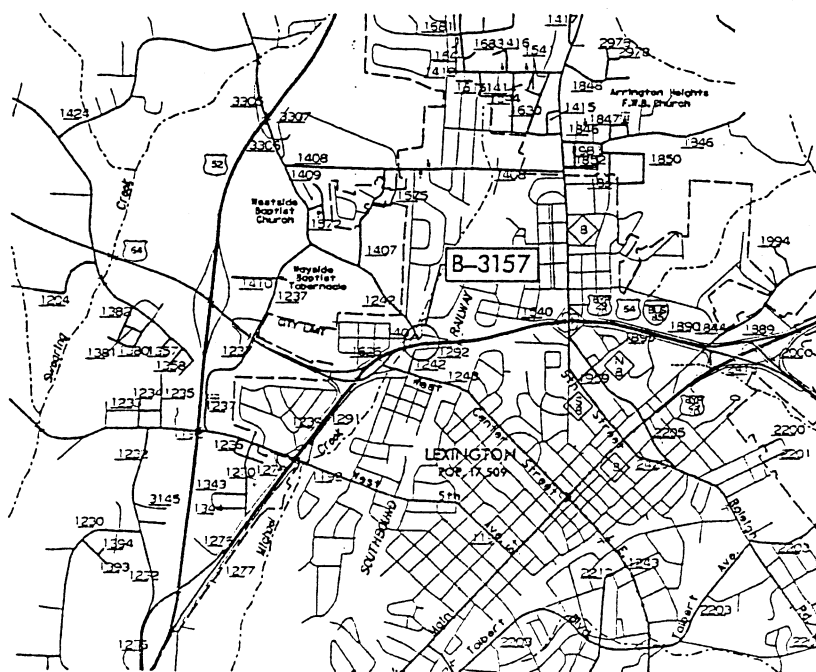
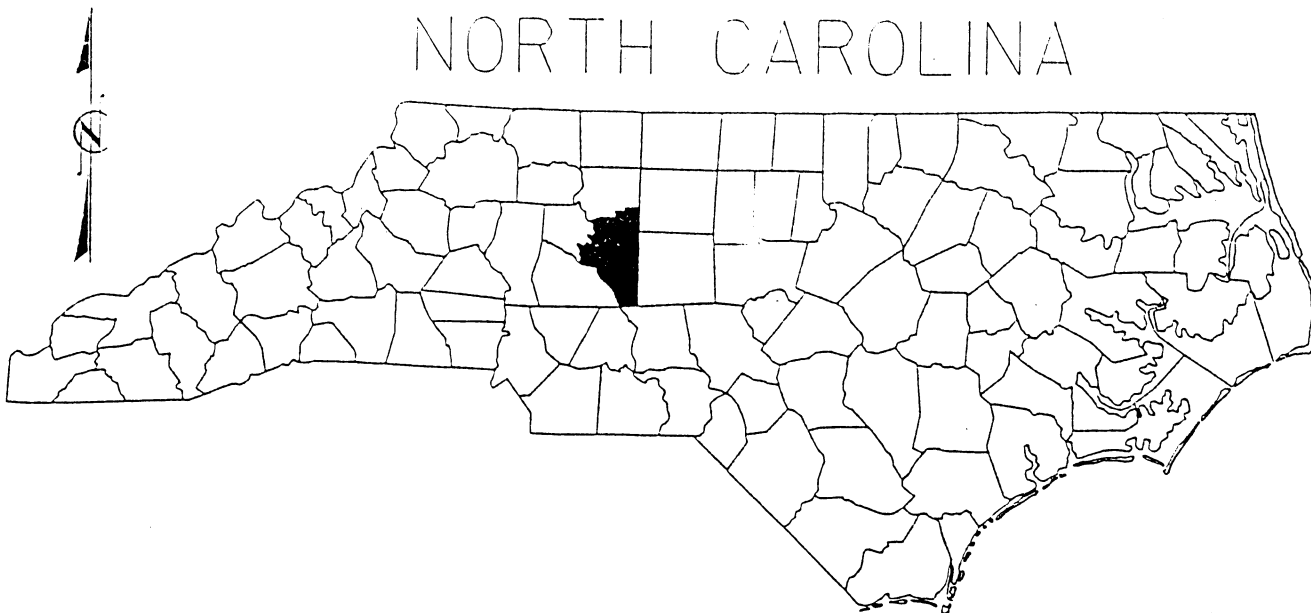
SIGNATURE OF AGENT

DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than \$10,000 or imprisoned not more than five years or both.

NORTH CAROLINA



VICINITY MAPS

NCDOT

DIVISION OF HIGHWAYS

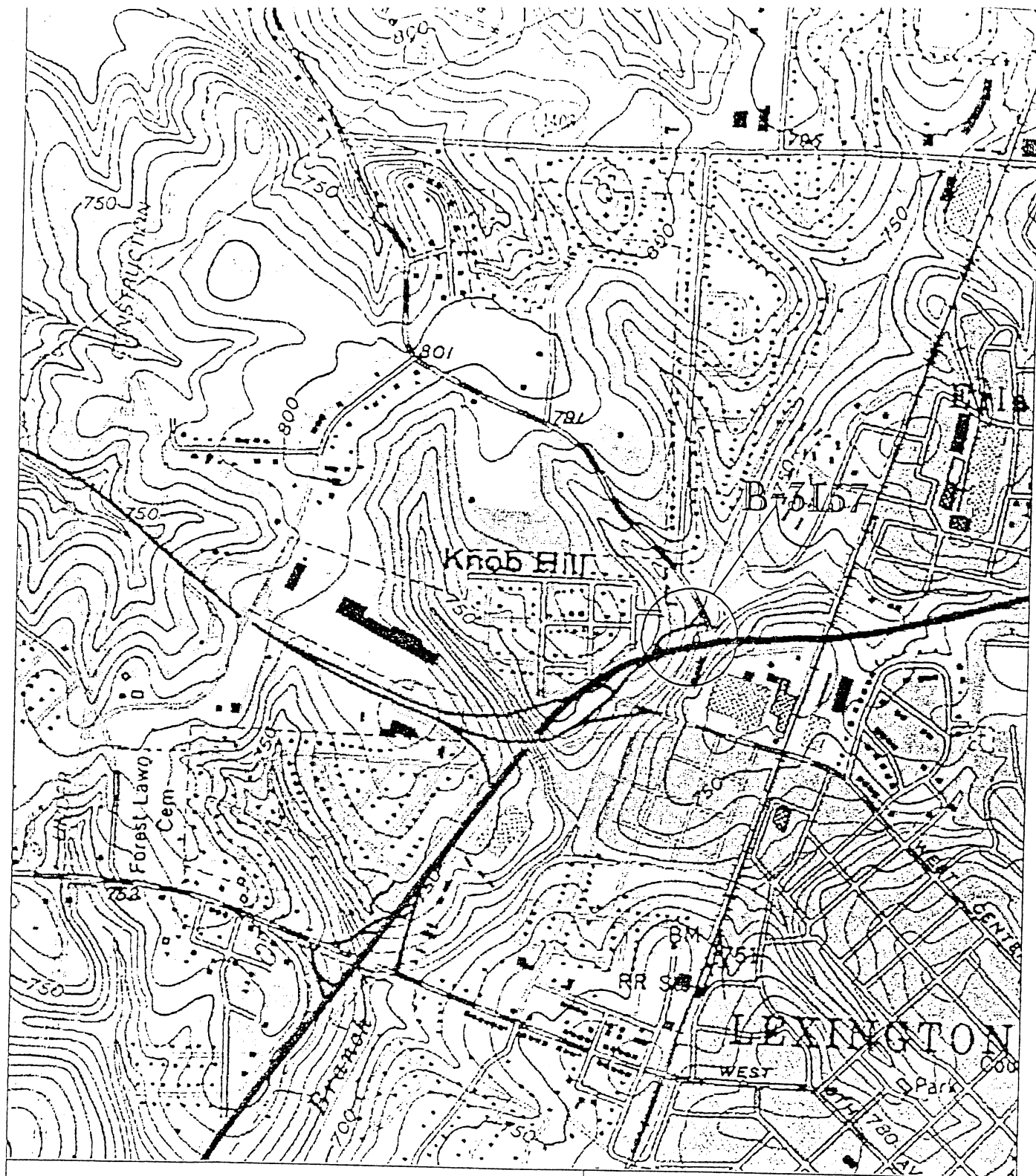
DAVIDSON COUNTY

PROJECT: 8.1631403 (B-3157)

BRIDGE NOS. 74 & 76 OVER SR1242 AND
MICHAEL CREEK AND APPROACHES
ON US 29/64/70 AND I-85 BUSINESS

SHEET 1 OF 31

5/27/05



TOPO MAP

SCALE 1"=2000'

NCDOT

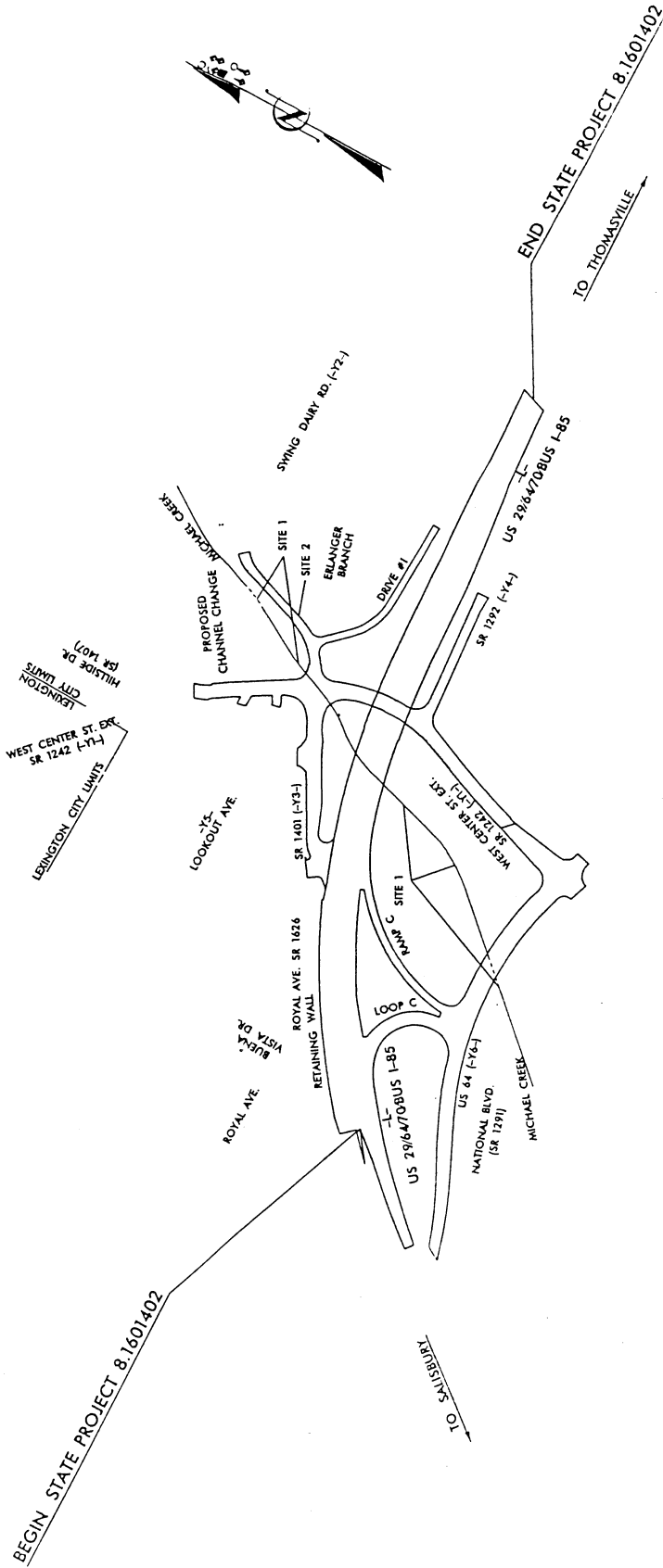
DIVISION OF HIGHWAYS
DAVIDSON COUNTY

PROJECT: 8.1631403 (B-3157)

BRIDGE NOS. 74 & 76 OVER SR1242 AND
MICHAEL CREEK AND APPROACHES
ON US 29/64/70 AND I-85 BUSINESS

SHEET 2 OF 31

5/27/05



NCDOT

DIVISION OF HIGHWAYS
DAVIDSON COUNTY

PROJECT: 8.1631403 (B-3157)

BRIDGE NOS. 74 & 76 OVER SR 1242 AND
MICHAEL CREEK AND APPROACHES
ON US 29/64/70 AND I-85 BUSINESS

SHEET 3 OF 31

10/28/03

SITE
MAP

PROPERTY OWNERS
NAMES AND ADDRESSES

PARCEL NO.	NAMES	ADDRESSES
1	LAWRENCE EDWARD LANNING	421 ROWE RD. LEXINGTON, NC 27292
2	FRANK & SONS INC.	P.O. BOX 276 CHARLOTTESVILLE, VA 22902

NCDOT

DIVISION OF HIGHWAYS

DAVIDSON COUNTY

PROJECT: 8.1631403 (B-3157)

**BRIDGE NOS. 74 & 76 OVER SR1242 AND
MICHAEL CREEK AND APPROACHES
ON US 29/64/70 AND I-85 BUSINESS**

WETLANDS IMPACT PERMIT SUMMARY

[illegible]

*10 feet of stream restoration deleted for utility easement

NCDOT

DIVISION OF HIGHWAYS
DAVIDSON COUNTY
PROJECT 8.1631403 (B-3157)
BRIDGE NOS. 74 & 76 OVER SR1242 AND
MICHAEL CREEK AND APPROACHES
ON US 29/64/70 AND I-85 BUSINESS

Form Revised 3/22/01

SHEET 5 OF 31

10/28/2003

Natural Channel Design Summary
Michael's Branch
TIP No. B-3157
State Project No. 8.1601403
Lexington, Davidson County, North Carolina

Prepared by Mulkey Engineers and Consultants

June 2003

This natural channel design summary is presented to the North Carolina Department of Transportation (NCDOT) as part of on-site compensatory mitigation for the proposed replacement of bridges number 74 and 76 over SR 1242 (West Center Street) and Michael's Creek on US 29/64/70 and I-85 Business. The proposed project extends from east of US 64 West to just west of the Winston Salem Southern Railroad. Michael's Branch, which flows through the entire project from north to south, will be relocated westward from its existing location parallel to Swing Dairy Road to the proposed culvert under SR 1242 (West Center Street). The stream will be restored utilizing priority two restoration from downstream of SR 1242 to the existing culvert under US 64 (-Y6-). Michael's Branch has been identified as a perennial stream and is part of the Yadkin – Pee Dee River Subbasin 03-07-07 (USGS Hydrologic Unit 03040103). The stream has been subdivided into three segments due to changes in drainage area and slopes. Segment one begins at the upstream project limits and extends to the confluence of Erlanger Branch. Segment two begins at the confluence of Erlanger Branch and extends to the new culvert under SR 1242 (West Center Street) and segment three runs from the outlet of the new culvert under SR 1242 to the existing culvert under US 64 Ramp (-Y6-). Morphological tables for each segment complete with existing channel, reference reach, and proposed reach characteristics is attached. In addition, proposed design and detail sheets are also included with this summary. The project is within the Piedmont physiographic province.

The headwaters associated with Michael's Branch originate at the intersection of SR 1412 and US 52. Michael's Branch flows in a southerly direction approximately 3.2 mi (5.1 km) before converging with Swearing Creek, then another 4.5 mi (7.2 km) to the south to unite with backwater from High Rock Lake. The drainage area at segment one is approximately 0.77 sq. mi (2.0 sq. km) and increases to 1.04 sq. mi (2.7 sq. km) with the confluence of Erlanger Branch. The drainage area for Michael's Branch is heavily urbanized with a combination of dense residential and commercial/industrial development. The proposed project will require the stream to be relocated due to existing fill slope design requirements upstream of SR 1242 and priority two restoration for on-site mitigation downstream of SR 1242. Overall stream length will be reduced and slope will be increased upstream of SR 1242 in order to correctly align the new channel with its modified valley type; however, downstream of SR 1242, the stream length will be increased and slope decreased due to the addition of more pattern.

Discharges for various return intervals were calculated using USGS report 96-4084 titled "Estimation of Flood-Frequency Characteristics of Small Urban Streams in North Carolina". Bankfull discharge was calculated based on field surveys of bankfull cross sectional area, longitudinal slope, and roughness factor. The calculated bankfull discharge was compared to the USGS discharges to determine an approximate return interval. The calculated bankfull discharge falls between the 1 and 2 year return interval storms; therefore, we conclude that field estimated bankfull is correct.

Existing Channel

Segment 1

A 300-foot (91.4-meter) section of the single thread channel associated with Michael's Branch was surveyed during April 2001. This section is located parallel to Swing Dairy Road (Y2) from the northern terminus of the project area to the confluence with Erlanger Branch. The surveyed reach exhibited channel characteristics similar to a G5c stream type, even though the ratios match an E stream type, as noted by the Rosgen Classification of Natural Rivers. The G5c stream type is an entrenched, moderately steep, step/pool channel deeply incised in sandy materials with relatively low sinuositities and width/depth ratios. This stream type is in degradation mode derived from near continuous channel adjustment due to excessive bank erosion. Bank erosion and bedload transport rates are typically high and the ratio of bedload to total sediment load often exceeds 50%. These stream types are very sensitive to disturbance and tend to make significant adverse channel adjustments to changes flow regime and sediment supply from the watershed (Rosgen and Silvey, 1998). The existing channel at this location has an entrenchment ratio of 2.3, but is in such a degraded state that it is functioning as a G. The channel has incised, actively widening and trying to develop pattern as observed by extremely undercut banks. Segment 1 of Michael's Branch exhibited a bankfull cross sectional area of 27 sq. ft (2.51 sq. m), an average slope of 0.006 ft/ft, and a D50 of 0.7mm. A detailed summary of existing channel conditions is presented in attached morphological table.

Segment 2

A 250-foot (76.2-meter) section of the single thread channel associated with Michael's Branch was surveyed during April 2001. This section is located parallel to Swing Dairy Road (Y2) from the confluence with Erlanger Branch to the existing double pipes under SR 1242. The surveyed reach exhibited channel characteristics similar to an E5/4 stream type as noted by the Rosgen Classification of Natural Rivers. The E5/4 stream type are systems with low to moderate sinuositities, gentle to moderately steep gradients, with very low width/depth ratios. The E5/4 stream type is typically seen as riffle/pool systems with streambanks composed of materials finer than that of the dominant channel materials, and are typically stabilized with extensive riparian vegetation. E5/4 stream types are hydraulically efficient channel forms and they maintain a high sediment transport capacity. These stream types are very sensitive to disturbance and tend to make significant adverse channel adjustments to changes flow regime and sediment supply from the watershed (Rosgen and Silvey, 1998). The existing channel at this location depicts geomorphic ratios similar to an E type, but is in such a degraded state that it is functioning as a G. The channel has incised and is actively widening and trying to develop pattern as observed by extremely undercut banks. Segment 2 of Michael's Branch exhibited a bankfull cross sectional area of 47 sq. ft. (4.37 sq. m), an average slope of 0.006 ft/ft and a D50 of 3mm. A detailed summary of existing channel conditions is presented in attached morphological table.

Segment 3

A 700-foot (213-meter) section of the single thread channel associated with Michael's Branch was surveyed during December 2002. This section is located between SR 1242 (West Center Street) and US 64 Ramp (Y6). The surveyed reach exhibited channel characteristics similar to a G5c stream type, even though the geomorphic ratios are similar to an E stream type, as noted by the Rosgen Classification of Natural Rivers. The G5c stream type is an entrenched, moderately steep, step/pool channel deeply incised

in sandy materials with relatively low sinuosities and width/depth ratios. This stream type is in degradation mode derived from near continuous channel adjustment due to excessive bank erosion. Bank erosion and bedload transport rates are typically high and the ratio of bedload to total sediment load often exceeds 50%. These stream types are very sensitive to disturbance and tend to make significant adverse channel adjustments to changes flow regime and sediment supply from the watershed (Rosgen and Silvey, 1998). As mentioned before, this stream exhibits an entrenchment ratio of 2.3; however, it is functioning as a G type. The channel has incised and is actively widening and trying to develop pattern as observed by extremely undercut banks. Segment 3 of Michael's Branch exhibited a bankfull cross sectional area of 50.3 sq. ft. (4.65 sq. m), an average slope of 0.004 ft/ft, and a D50 of 1.8mm. A detailed summary of existing channel conditions is presented in attached morphological table.

Reference Reach

Due to the urban nature of the existing stream's watershed a suitable reference reach was difficult to locate. Two stable streams, UT Lake Jeanette in Guilford County and an UT to SW Prong Beaverdam Creek in Wake County were selected as the reference reaches. UT to Lake Jeanette was selected based on its location within the same eco-region as the restoration, its watershed components, stream type, and other general characteristics. The reference reach channel is situated in Guilford County and classifies as a C4. It exhibits a drainage area of 0.25 sq. mi (0.65 sq. km) and a bankfull cross sectional area of 7.7 sq. ft (0.72 sq. m.). Based on surveys, the channel is stable and exhibits very low bank height ratios. UT to SW Prong Beaverdam Creek was selected based on its urban watershed, stream type, and other general characteristics. The reference reach channel is situated in Wake County and classifies as a C5. It exhibits a drainage area of 0.28 sq. mi (0.73 sq. km) and a bankfull cross sectional area of 13.0 sq. ft (1.21 sq. m.). Based on surveys, the channel is stable and exhibits very low bank height ratios. Both stream's valley characteristics are very comparable with the existing channel. Little to no bank erosion was noted at either reference reach during the survey. A detailed summary of reference conditions are also presented in the attached morphological table.

Proposed Channel

Segment 1

The proposed channel was based on dimensionless ratios derived from the reference reach survey, existing channel survey, and data interpretation. The bankfull width will be increased from 13.0 ft (4.0 m) to 21.0 ft (6.4 m) and the bankfull mean depth will be reduced from 2.07 ft (0.63 m) to 1.40 ft (0.43 m). As a result, the width/depth ratio will increase to approximately 15 from the existing 6.3 ratio. A decrease in the bankfull mean velocity will occur with the new channel. The design stream will exhibit additional floodprone area to aid in stress reduction in the channel. Slopes will be increased due to a change in the valley; however, an excess energy will be dissipated via riffle/pool morphology characteristic and planform associated with the C stream type. Rock cross vanes will be the primary method influencing the riffle/pool morphology. These cross vanes will be established throughout the channel in riffle sections and used to provide grade control, center the thalweg, and protect the stream banks on both sides of the new channel until vegetation is established. The cross vanes will also decrease shear

stresses throughout the reach. The riparian zone adjacent to the channel will be planted with native vegetation conducive to wetter, floodplain areas.

Proposed channel stabilization characteristics are presented on the attached detail sheet. It is anticipated that the riparian zone will be planted with native trees and shrubs above bankfull depth and herbaceous species within the channel.

Segment 2

The proposed channel was based on dimensionless ratios derived from the reference reach survey, existing channel survey, and data interpretation. The bankfull width will be increased from 22.5 ft (6.9 m) to 26 ft (7.9 m) and the bankfull mean depth will be reduced from 2.09 ft (0.64 m) to 1.70 ft (0.52 m). As a result, the width/depth ratio will increase to approximately 15.3 from the existing 9.7 ratio. An increase in bankfull velocity will occur due to the steeper gradient of the stream; therefore, the bankfull area is slightly reduced in the proposed condition. The design stream will exhibit additional floodprone area to aid in stress reduction in the channel. Slopes will be increased due to a change in the valley; however, an excess energy will be dissipated via riffle/pool morphology characteristic and planform associated with the C stream type. Rock cross vanes will be the primary method influencing the riffle/pool morphology. These cross vanes will be established throughout the channel in riffle sections and used to provide grade control, center the thalweg, and protect the stream banks on both sides of the new channel until vegetation is established. The cross vanes will also decrease shear stresses throughout the reach. The riparian zone adjacent to the channel will be planted with native vegetation conducive to wetter, floodplain areas.

Proposed channel stabilization characteristics are presented on the attached detail sheet. It is anticipated that the riparian zone will be planted with native trees and shrubs above bankfull depth and herbaceous species within the channel.

Segment 3

The proposed channel was based on dimensionless ratios derived from the reference reach survey, existing channel survey, and data interpretation. The bankfull width will be increased from 21.0 ft (6.4 m) to 28.0 ft (8.5 m) and the bankfull mean depth will be reduced from 2.51 ft (0.77 m) to 2.25 ft (0.68 m). As a result, the width/depth ratio will increase to approximately 12.4 from the existing 8.0 ratio. A decrease in the bankfull mean velocity will occur with the new channel. The design stream will exhibit additional floodprone area to aid in stress reduction in the channel. Slopes will be increased due to a change in the valley; however, an excess energy will be dissipated via riffle/pool morphology characteristic and planform associated with the C stream type. Rock cross vanes will be the primary method influencing the riffle/pool morphology. These cross vanes will be established throughout the channel in riffle sections and used to provide grade control, center the thalweg, and protect the stream banks on both sides of the new channel until vegetation is established. The cross vanes will also decrease shear stresses throughout the reach. The riparian zone adjacent to the channel will be planted with native vegetation conducive to wetter, floodplain areas.

Proposed channel stabilization characteristics are presented on the attached detail sheet. It is anticipated that the riparian zone will be planted with native trees and shrubs above bankfull depth and herbaceous species within the channel.

Sediment Transport

Segment 1

Based on pebble counts and bar samples taken along the existing channel, the D50 averages 0.7 mm and the D84 averages approximately 30.0 mm. The existing channel exhibits a critical shear stress of 0.55 lbs/ft² which may entrain up to a 35 mm particle. Based on the design, the proposed channel will exhibit a critical shear stress of 0.66 lbs/ft² entraining up to a 40 mm particle. This increase in entrainment will not induce degradation as the active bed sample produced a D84 of 38mm. In addition, cross vanes will be installed throughout the riffle sections to further reduce the possibility of additional channel degradation.

Segment 2

Based on pebble counts and bar samples taken along the existing channel, the D50 averages 0.7 mm and the D84 averages approximately 30.0 mm. The existing channel exhibits a critical shear stress of 0.65 lbs/ft² which may entrain up to a 40 mm particle. Based on the design, the proposed channel will exhibit a critical shear stress of 0.78 lbs/ft² entraining up to a 48 mm particle. This increase in entrainment will not induce degradation as the active bed sample produced a D84 of 40mm. In addition, cross vanes will be installed throughout the riffle sections to further reduce the possibility of additional channel degradation.

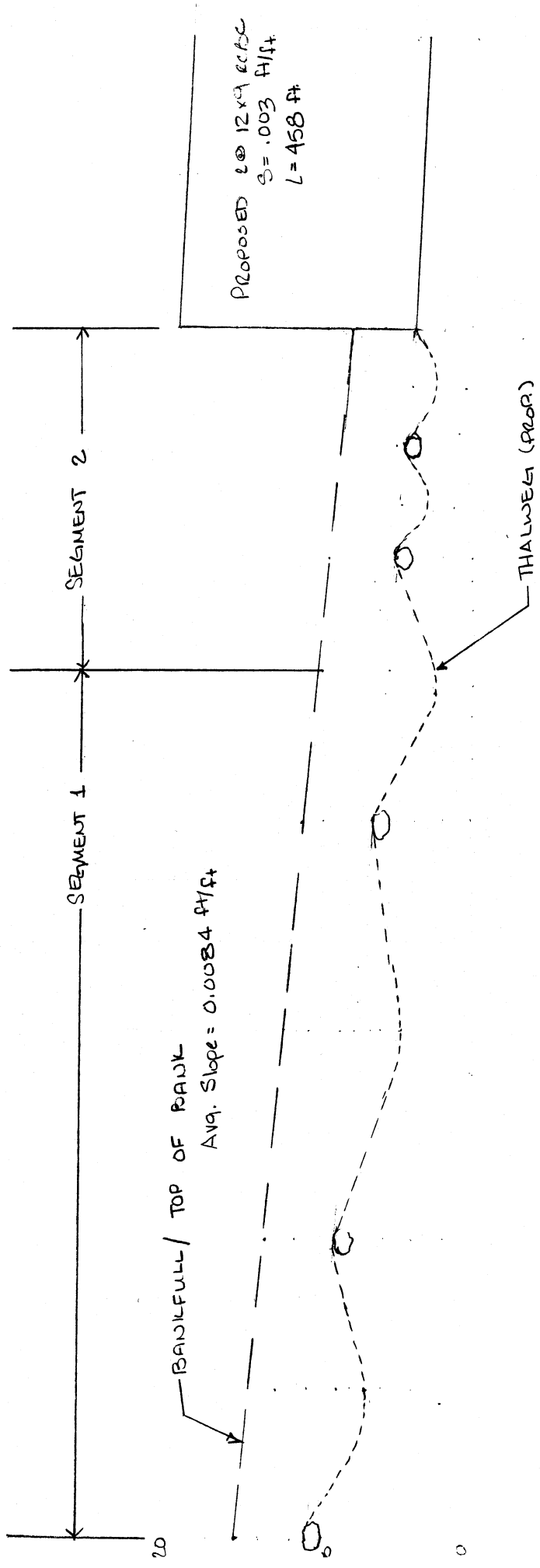
Segment 3

Based on pebble counts and bar samples taken along the existing channel, the D50 averages 0.8 mm and the D84 averages approximately 10.0 mm. The existing channel exhibits a critical shear stress of 0.50 lbs/ft² which may entrain up to a 32 mm particle. Based on the design, the proposed channel will exhibit a critical shear stress of 0.33 lbs/ft² entraining up to a 18 mm particle. This increase in entrainment will not induce degradation as the active bed sample produced a D84 of 18mm. In addition, cross vanes will be installed throughout the riffle sections to further reduce the possibility of additional channel degradation.

References

North Carolina Department of Environment and Natural Resources (NCDENR), 1998. Yadkin/Pee Dee Basinwide Water Quality Management Plan.

Rosgen, D. and L. Silvey, 1998. Field Guide for Stream Classification. Wildland Hydrology, Inc.



B-3157 - MICHAEL'S BLANKET
 PROPOSED CHANNEL PROFILE
 SEGMENTS 1 & 2

LEXINGTON
 DAVIDSON CO.

0 100 200 300 400 500

SEGMENT 3

PROPOSED
2012x9 R&B
S=0.003 ft/ft
L=450'

BANKFULL TOP OF BANK
AVG. SLOPE = 0.0028 ft/ft

PROPOSED THAWEG

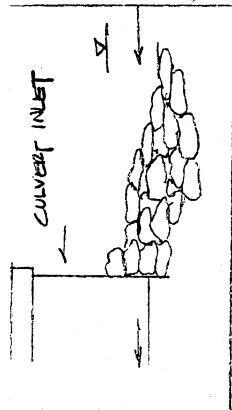
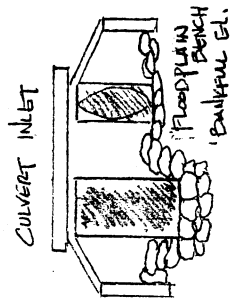
EXISTING
BEDROCK

B-3157- MICHAEL'S BRANCH
PROPOSED CHANNEL PROFILE
SEGMENT 3
LEXINGTON, DAVIDSON CO.

800 900 1000 1100 1200 1300

Sheet 12 of 31

101271103



DETAIL OF CULVERT
INLET w/ SUPPLEMENTAL PIPE

EXISTING 10x10' RCP
TO BE EXTENDED
& SUPPLEMENTED
w/ 72" RCP

BANKFULL TOP OF BANK
AVG. SLOPE = 0.0028 ft/ft

PROPOSED THALWEG

B-3157. MICHAEL'S BRANCH
PROPOSED CHANNEL PROFILE
SEGMENT 3
LEXINGTON, DAVIDSON CO.

4/27/03

Sheet 13 of 31

1000

1500

1400

1300

Appendix B

Morphological Measurement Table (Seg. #1)

Variables	Existing Channel	Proposed Reach	Reference Reach	Reference Reach
1. Stream type	G5*	C4/5	C5-Urban	C4
2. Drainage area	0.77 sq.mi.	0.77 sq. mi.	0.28 sq. mi.	0.26 sq. mi.
3. Bankfull width	13 ft.	21 ft.	12.5 ft.	9.5 ft.
4. Bankfull mean depth	2.07 ft.	1.4 ft.	0.9 ft.	0.8 ft.
5. Width/depth ratio	6.28	15	13.8	11.7
6. Bankfull cross-sectional area	27 sq. ft.	30 sq. ft.	11.4 sq. ft.	7.7 sq. ft.
7. Bankfull mean velocity	6.32 ft/s	5.6 ft/s		
8. Bankfull discharge, cfs	170 cfs	170 cfs		
9. Bankfull max depth	3.48 ft.	2.1 ft.	1.3 ft.	1.3 ft.
10. Width of floodprone area	30 ft.	100 ft.	90 ft.	36 ft.
11. Entrenchment ratio	2.3	4.76	7.1	3.8
12. Meander length	116 ft.	230	Range:33-144 ft. Avg: 71 ft.	Range: 29-69 ft. Avg: 50.2 ft.
13. Ratio of meander length to bankfull width	8.92	10.9	5.7	5.3
14. Radius of curvature	32.0 ft.	Range: 55-135 ft. Avg: 89 ft.	Range: 11.1-38 ft. Avg: 18 ft.	Range: 5.3-22 ft. Avg: 9.7 ft.
15. Ratio of radius of curvature to bankfull width	2.46	4.2	1.4	1.02
16. Belt width	72.0 ft.	70 ft.	Range: 30-119 ft. Avg: 71 ft.	Range: 26-40 ft. Avg: 33 ft.
17. Meander width ratio	5.5	3.3	6	3.5
18. Sinuosity (stream length/valley length)	107	1.19	2.22	1.35
19. Valley slope	0.60%	1.00%	3%	0.76%
20. Average slope	0.56%	0.84%	1.30%	0.57%
21. Pool slope	0.14%	0.08%	0.11%	0.0005%
22. Ratio of pool slope to average slope	0.25	0.1	0.085	0.082
23. Maximum pool depth	4.2 ft.	4.0 ft.	2.3 ft.	2.9 ft.
24. Ratio of pool depth to average bankfull depth	1.8	2.85	2.56	3.6
25. Pool width	38 ft.	25 ft.	10.7 ft.	10.5 ft.
26. Ratio of pool width to bankfull width	2.9	1.2	0.86	1.1
27. Pool to pool spacing	190 ft.	115 ft.	Range: 18-58 ft. Avg: 36.5 ft.	Range: 20.7-54.8 ft. Avg: 40.2 ft.
28. Ratio of pool to pool spacing to bankfull width	14.6	5.5	2.92	4.23

*Entrenchment ratio is greater than 2.2 but the stream is functioning as an G type channel.

Entrainment Calculation Form

Project: B-3157 Segment #1
 Stream: Michael's Branch
 Date: 5/19/2003

Location: Lexington, NC
 Reach: Proposed Channel
 Observers: JSF, CSC

Critical Dimensionless Shear Stress:		
$T_{ci} = 0.0834(di/d50)^{-0.872}$		
Value	Variable	Definition
.18	di mm	D50 from Riffle or Pavement* *Choose
0.8	d50 mm	D50 from Bar Sample or Sub Pavement* One
0.0055	Tci	Critical Dimensionless Shear Stress
Bankfull Mean Depth Required for Entrainment of largest particle in Bar Sample: $dr = (T_{ci} * 1.65 * Di) / Se$ 1.65 = submerged specific weight of sediment		
38	mm	Largest Bar Sample Particle in mm
0.12	Di ft	Largest Bar Sample Particle in ft
0.0084	Se ft/ft	Bankfull Water Surface Slope
0.14	dr ft	Bankfull Mean Depth Required
1.40	de ft	Bankfull Mean Depth (From Riffle Cross Section)
de/dr=	10.35	if = 1 <1 >1
Choose one:		Stable aggrading Degrading
Bankfull Water Surface Slope Required for Entrainment of largest particle in Bar Sample: $Sr = (T_{ci} * 1.65 * Di) / de$ 1.65 = submerged specific weight of sediment		
0.12	Di ft	Largest Bar Sample Particle
1.40	de ft	Bankfull Mean Depth (From Riffle Cross Section)
0.0008	Sr ft/ft	Bankfull Water Surface Slope Required
Se/Sr=	10.35	if = 1 <1 >1
Choose one:		Stable aggrading Degrading
Sediment Transport Validation - Bankfull Shear Stress $T_c = \gamma R S$		
62.4	γ lbs/cu ft	Density of water
1.26	R=A/Wp	
30	A sq ft	Bankfull Cross-Sectional Area
23.8	Wp	Wetted parameter
0.0084	S ft/ft	Bankfull Water Surface Slope (2*1.1)+14
0.660706	Tc lb/sqr ft	$T_c = \gamma R S$
38	Di mm	Largest Bar Sample Particle (mm)
		Moveable Particle size (mm) at Bankfull Shear Stress
40	mm	predicted by the Shields diagram, Red field book: p.190; Blue: p.238
		Predicted Shear Stress Required to move Di (lb/ft ²)
0.62	lb/ft ²	predicted by the Shields diagram, Red field book: p.190; Blue: p.238

Appendix B

Morphological Measurement Table (Seg. #2)

Variables	Existing Channel	Proposed Reach	Reference Reach	Reference Reach
1. Stream type	E4/5*	C4/5	C5-Urban	C4
2. Drainage area	1.04 sq. mi.	1.04 sq. mi.	0.28 sq. mi.	0.26 sq. mi.
3. Bankfull width	22.5 ft.	26 ft.	12.5 ft.	9.5 ft.
4. Bankfull mean depth	2.09 ft.	1.70 ft.	0.9 ft.	0.8 ft.
5. Width/depth ratio	9.7	15.3	13.8	11.7
6. Bankfull cross-sectional area	47 sq. ft.	44 sq. ft.	11.4 sq. ft.	7.7 sq. ft.
7. Bankfull mean velocity	5.98 ft/s	6.43 ft/s		
8. Bankfull discharge, cfs	280 cfs	280 cfs		
9. Bankfull max depth	3.3 ft.	2.55 ft.	1.3 ft.	1.3 ft.
10. Width of floodprone area	196.0 ft.	100 ft.	90 ft.	36 ft.
11. Entrenchment ratio	8.7	3.85	7.1	3.8
12. Meander length	116.0 ft	180 ft.	Range: 33-144 ft. Avg: 71 ft.	Range: 29-69 ft. Avg: 50.2 ft.
13. Ratio of meander length to bankfull width	5.15	6.9	5.7	5.3
14. Radius of curvature	32.0 ft.	Range: 55-80 ft. Avg: 67.5 ft.	Range: 11.1-38 ft. Avg: 18 ft.	Range: 5.3-22 ft. Avg: 9.7 ft.
15. Ratio of radius of curvature to bankfull width	1.06	2.6	1.4	1.02
16. Belt width	72.0 ft.	72.0 ft.	Range: 30-119 ft. Avg: 71 ft.	Range: 26-40 ft. Avg: 33 ft.
17. Meander width ratio	3.2	2.8	6	3.5
18. Sinuosity (stream length/valley length)	1.07	1.2	2.22	1.35
19. Valley slope	0.60%	1.00%	3.00%	0.76%
20. Average slope	0.56%	0.84%	1.30%	0.57%
21. Pool slope	0.14%	0.08%	0.11%	0.0005%
22. Ratio of pool slope to average slope	0.25	0.1	0.09	0.082
23. Maximum pool depth	4.20 ft.	4.0 ft.	2.30 ft.	2.9 ft.
24. Ratio of pool depth to average bankfull depth	2.00	2.35	2.56	3.6
25. Pool width	38.0 ft.	31 ft.	10.7 ft.	10.5 ft.
26. Ratio of pool width to bankfull width	1.69	1.22	0.86	1.1
27. Pool to pool spacing	190.0 ft.	85 ft.	Range: 18-58 ft. Avg: 36.5 ft.	Range: 20.7-54.8 ft. Avg: 40.2 ft.
28. Ratio of pool to pool spacing to bankfull width	8.44	3.26	2.92	4.23

*Based on numbers the existing channel classifies as an E; however, the stream is severely incised and unstable.

Entrainment Calculation Form

Project: B-3157 (segment 2)
 Stream: Michael's Branch
 Date: 5/21/2003

Location: Lexington, NC
 Reach: Proposed Channel
 Observers: JFS, CLM

Critical Dimensionless Shear Stress:		
$T_{ci} = 0.0834(d_i/d_{50})^{-0.872}$		
Value	Variable	Definition
18	di mm	D50 from Riffle or Pavement* *Choose
0.8	d50 mm	D50 from Bar Sample or Sub Pavement* One
0.0055	Tci	Critical Dimensionless Shear Stress
Bankfull Mean Depth Required for Entrainment of largest particle in Bar Sample: $d_r = (T_{ci} \cdot 1.65 \cdot D_i) / S_e$ 1.65 = submerged specific weight of sediment		
38	mm	Largest Bar Sample Particle in mm
0.12	Di ft	Largest Bar Sample Particle in ft
0.0084	Se ft/ft	Proposed Bankfull Water Surface Slope
0.14	dr ft	Bankfull Mean Depth Required
1.70	de ft	Proposed Bankfull Mean Depth (From Riffle Cross Section)
de/dr=	12.57	if = 1 <1 >1
Choose one:		Stable aggrading Degrading
Bankfull Water Surface Slope Required for Entrainment of largest particle in Bar Sample: $S_r = (T_{ci} \cdot 1.65 \cdot D_i) / d_e$ 1.65 = submerged specific weight of sediment		
0.12	Di ft	Largest Bar Sample Particle
1.70	de ft	Proposed Bankfull Mean Depth (From Riffle Cross Section)
0.0007	Sr ft/ft	Bankfull Water Surface Slope Required
Se/Sr=	12.57	if = 1 <1 >1
Choose one:		Stable aggrading Degrading
Sediment Transport Validation - Bankfull Shear Stress $T_c = \gamma R S$		
62.4	γ lbs/cu ft	Density of water
1.50	R=A/Wp	Hydraulic Radius
44	A sq ft	Proposed Bankfull Cross-Sectional Area
29.4	Wp	Wetted Perimeter
0.0084	S ft/ft	Proposed Bankfull Water Surface Slope (2*1.1)+14
0.784457	Tc lb/sqr ft	$T_c = \gamma R S$
38	Di mm	Largest Bar Sample Particle (mm)
		Moveable Particle size (mm) at Bankfull Shear Stress
48	mm	predicted by the Shields diagram, Red field book: p.190; Blue: p.238
		Predicted Shear Stress Required to move Di (lb/ft2)
0.62	lb/ft2	predicted by the Shields diagram, Red field book: p.190; Blue: p.238

Appendix B

Morphological Measurement Table (Seg. #3)

Variables	Existing Channel	Proposed Reach	Reference Reach	Reference Reach
1. Stream type	G5-Urban*	C5	C5-Urban	C4
2. Drainage area	1.04 sq. mi.	1.04 sq. mi.	0.28 sq. mi.	0.26 sq. mi.
3. Bankfull width	21.0 ft.	28 ft.	12.5 ft.	9.5 ft.
4. Bankfull mean depth	2.51 ft.	2.25 ft.	0.9 ft.	0.8 ft.
5. Width/depth ratio	8	12.4	13.8	11.7
6. Bankfull cross-sectional area	50.3 sq. ft.	63 sq. ft.	11.4 sq. ft.	7.7 sq. ft.
7. Bankfull mean velocity	5.43 ft/s	4.45 ft/s		4.55 ft/s
8. Bankfull discharge, cfs	280 cfs	280 cfs		35 cfs
9. Bankfull max depth	3.8 ft.	3.4 ft.	1.3 ft.	1.3 ft.
10. Width of floodprone area	46.0 ft.	95 ft.	90 ft.	36 ft.
11. Entrenchment ratio	2.3	3.4	7.1	3.8
12. Meander length	Not Available	Range: 100-200 ft. Avg: 138 ft.	Range: 33-144 ft. Avg: 71.0 ft.	Range: 29-69 ft. Avg: 50.2 ft.
13. Ratio of meander length to bankfull width	Not Available	4.6	5.7	5.3
14. Radius of curvature	60.0 ft.	Range: 55-87.5 ft. Avg: 69 ft.	Range: 11.1+-38 ft. Avg: 18 ft.	Range: 5.3-22 ft. Avg: 9.7 ft.
15. Ratio of radius of curvature to bankfull width	2.86	2.5	1.4	1.02
16. Belt width	75.0 ft.	Range: 40-70 ft. Avg: 55 ft.	Range: 30-119 ft. Avg: 71 ft.	Range: 26-40 ft. Avg: 33 ft.
17. Meander width ratio	3.57	2.0	6.0	3.5
18. Sinuosity (stream length/valley length)	1.07	1.45	2.22	1.35
19. Valley slope	0.40%	0.40%	3%	0.76%
20. Average slope	0.40%	0.28%	1.30%	0.57%
21. Pool slope	0.17%	0.03%	0.11%	0.0005%
22. Ratio of pool slope to average slope	0.43	0.1	0.09	0.082
23. Maximum pool depth	3.77 ft.	5.5 ft.	2.30 ft.	2.9 ft.
24. Ratio of pool depth to average bankfull depth	1.5	2.4	2.56	3.6
25. Pool width	19.5 ft.	33.6 ft.	10.7 ft.	10.5 ft.
26. Ratio of pool width to bankfull width	0.93	1.2	0.86	1.1
27. Pool to pool spacing	106.8 ft.	Range: 46-107 ft. Avg: 75 ft.	Range: 18-58 ft. Avg: 36.5 ft.	Range: 20.7-54.8 ft. Avg: 40.2 ft.
28. Ratio of pool to pool spacing to bankfull width	5.09	2.67	2.92	4.23

*Entrenchment ratio is greater the 2.2 but the stream is functioning as a "G".

Location:	<u>Lexington, NC</u>
Reach:	<u>Proposed Channel</u>
Observers:	<u>GLS, TBB, CSC</u>

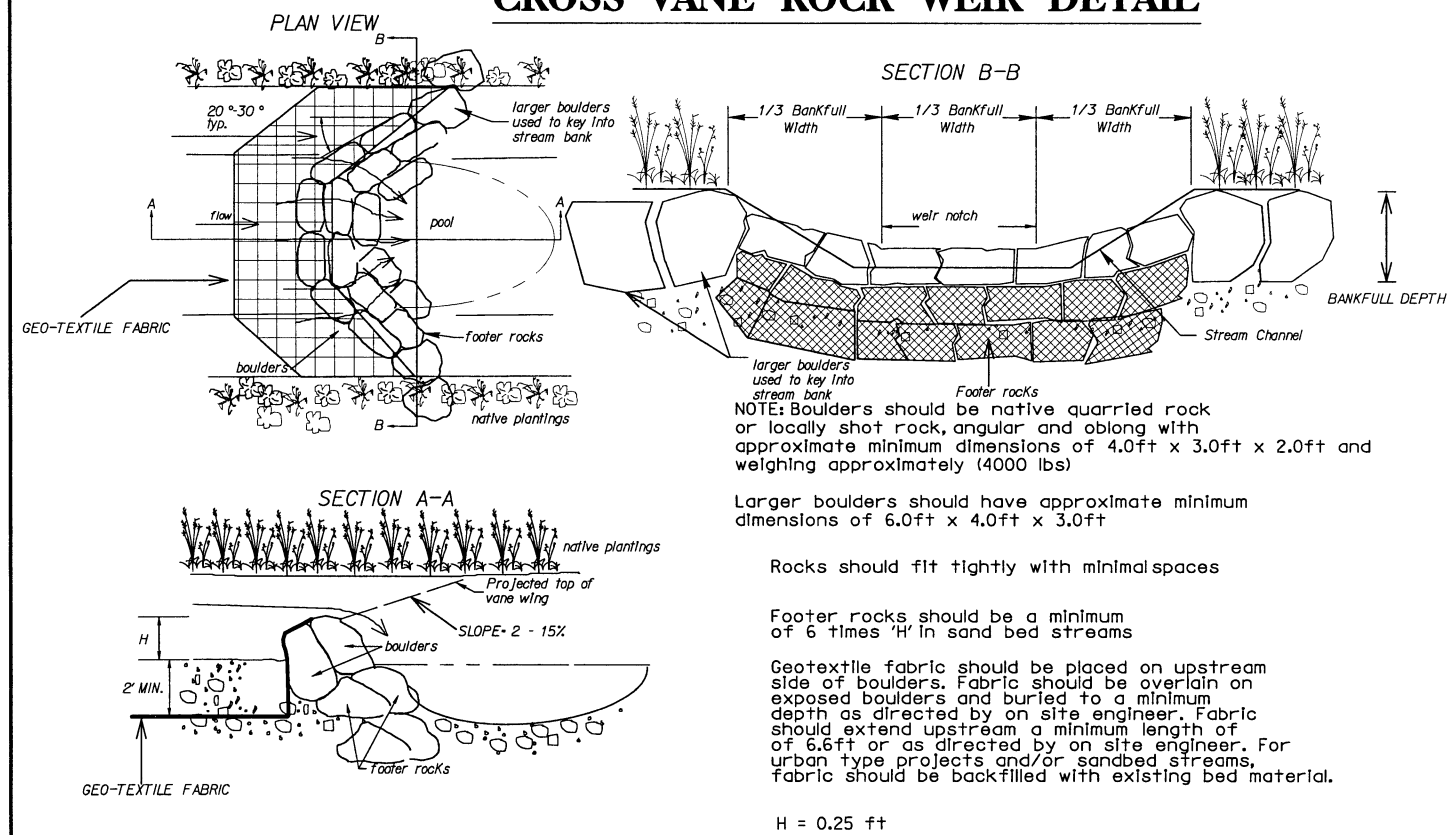
Critical Dimensionless Shear Stress:					
$T_{ci} = 0.0834(d_i/d_{50})^{-0.872}$					
Value	Variable	Definition			
18	d_i mm	D50 from Riffle or Pavement*	*Choose One		
0.8	d_{50} mm	D50 from Bar Sample or Sub Pavement*			
0.0055	T_{ci}	Critical Dimensionless Shear Stress			
		Bankfull Mean Depth Required for Entrainment of largest particle in Bar Sample: $d_r = (T_{ci} \cdot 1.65 \cdot D_i) / S_e$ 1.65 = submerged specific weight of sediment			
18	mm	Largest Bar Sample Particle in mm			
0.06	D_i ft	Largest Bar Sample Particle in ft			
0.0028	S_e ft/ft	Proposed Bankfull Water Surface Slope			
0.20	d_r ft	Bankfull Mean Depth Required			
2.25	d_e ft	Proposed Bankfull Mean Depth (<i>From Riffle Cross Section</i>)			
$d_e/d_r =$	11.50	if = 1	<1	>1	
Choose one:		Stable	aggrading	Degrading	
		Bankfull Water Surface Slope Required for Entrainment of largest particle in Bar Sample: $S_r = (T_{ci} \cdot 1.65 \cdot D_i) / d_e$ 1.65 = submerged specific weight of sediment			
0.06	D_i ft	Largest Bar Sample Particle			
2.25	d_e ft	Proposed Bankfull Mean Depth (<i>From Riffle Cross Section</i>)			
0.0002	S_r ft/ft	Bankfull Water Surface Slope Required			
$S_e/S_r =$	11.50	if = 1	<1	>1	
Choose one:		Stable	aggrading	Degrading	
		Sediment Transport Validation - Bankfull Shear Stress $T_c = yRS$			
62.4	γ lbs/cu ft	Density of water			
1.94	$R=A/W_p$	Hydraulic Radius			
63	A sq ft	Proposed Bankfull Cross-Sectional Area			
32.5	W_p	Wetted Perimeter			
0.0028	S ft/ft	Proposed Bankfull Water Surface Slope (2*1.1)+14			
0.33264	T_c lb/sqr ft	$T_c = yRS$			
18	D_i mm	Largest Bar Sample Particle (mm)			
		Moveable Particle size (mm) at Bankfull Shear Stress			
18	mm	predicted by the Shields diagram, Red field book: p.190; Blue: p.238			
		Predicted Shear Stress Required to move D_i (lb/ft ²)			
0.33	lb/ft ²	predicted by the Shields diagram, Red field book: p.190; Blue: p.238			

NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE

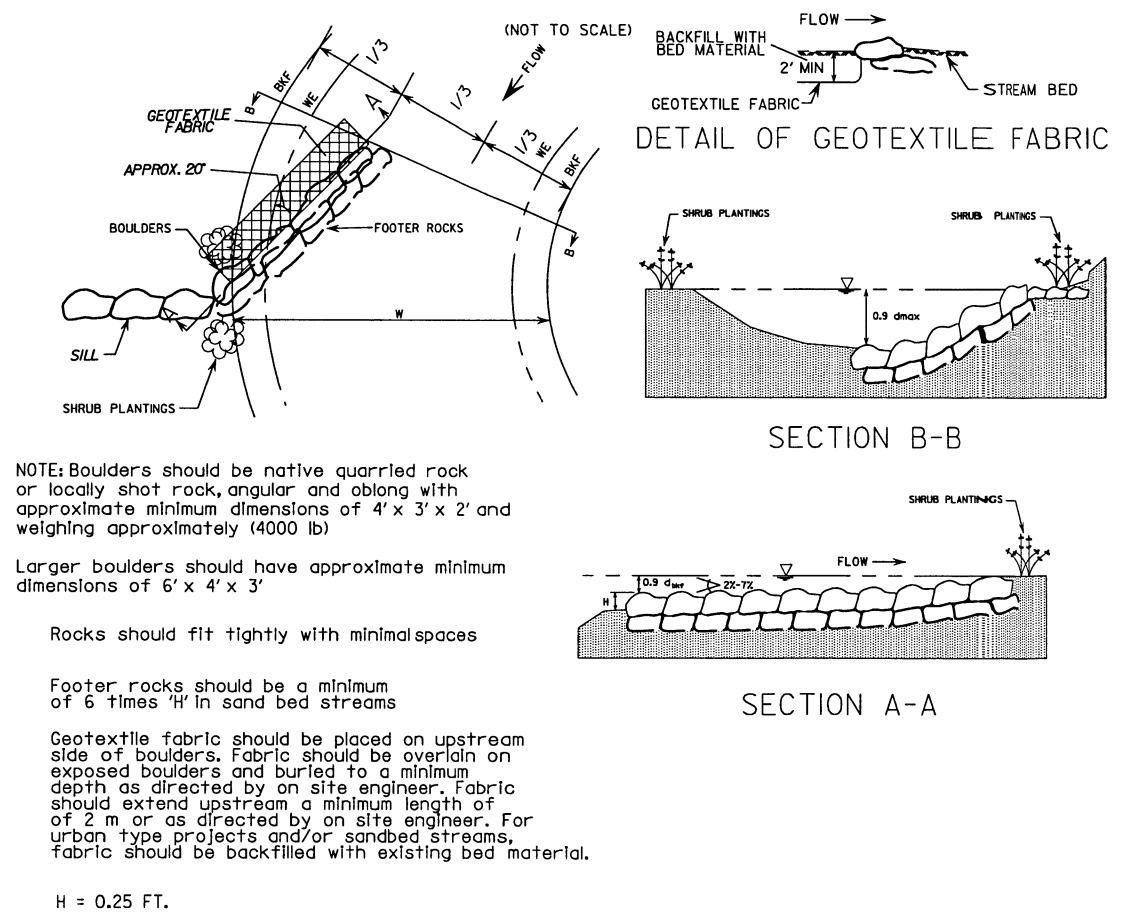
sheet 20 of 31

CROSS VANE ROCK WEIR DETAIL

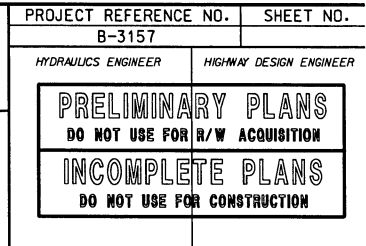


CROSS VANE TYPICAL

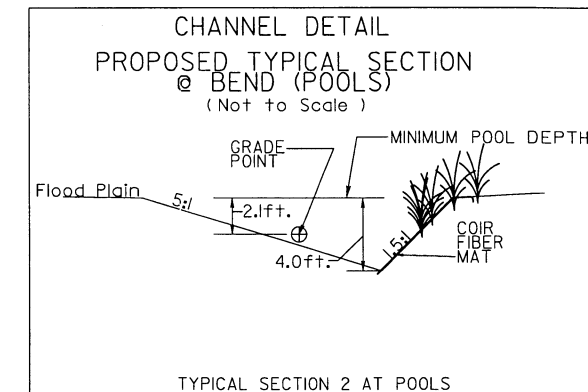
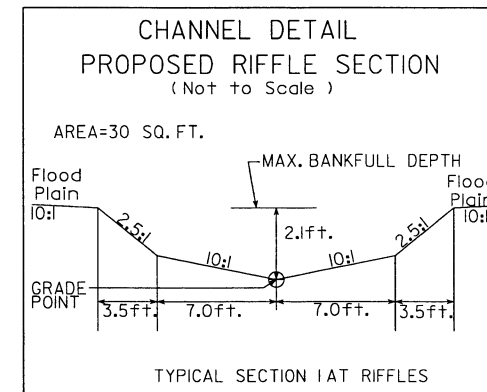
ROCK VANE



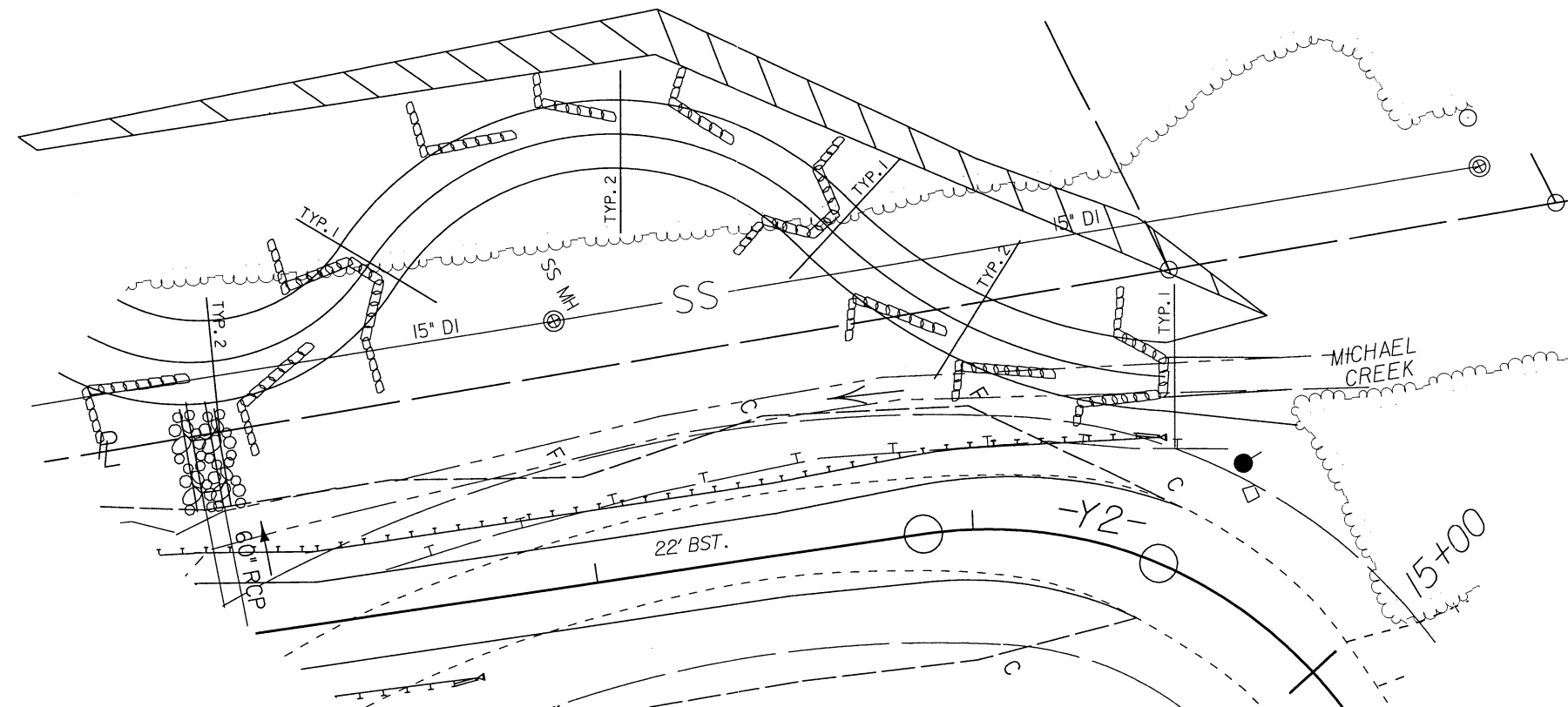
ROCK VANE TYPICAL



Sheet 21 of 31



DDE = 6500CY
BOULDERS = 200@4000LB.
55@2000LB.
COIR FIBER MAT = 300SY
GEOTEXTILE FABRIC = 200SY



CHANNEL PLAN VIEW

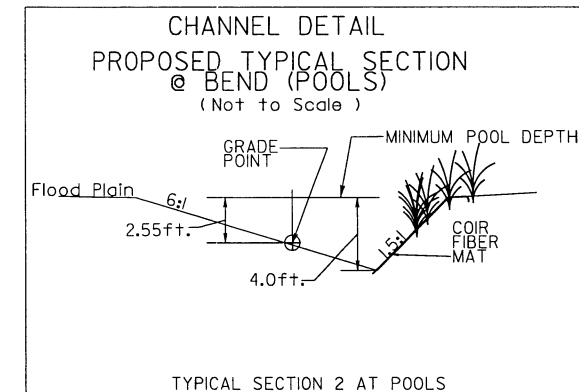
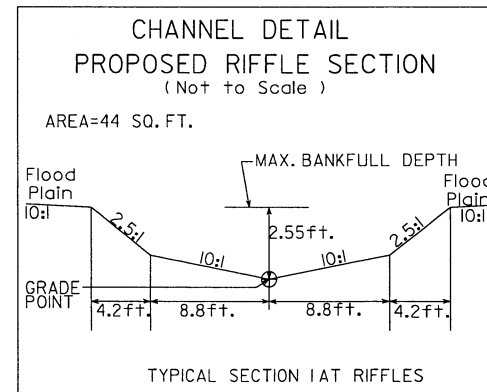
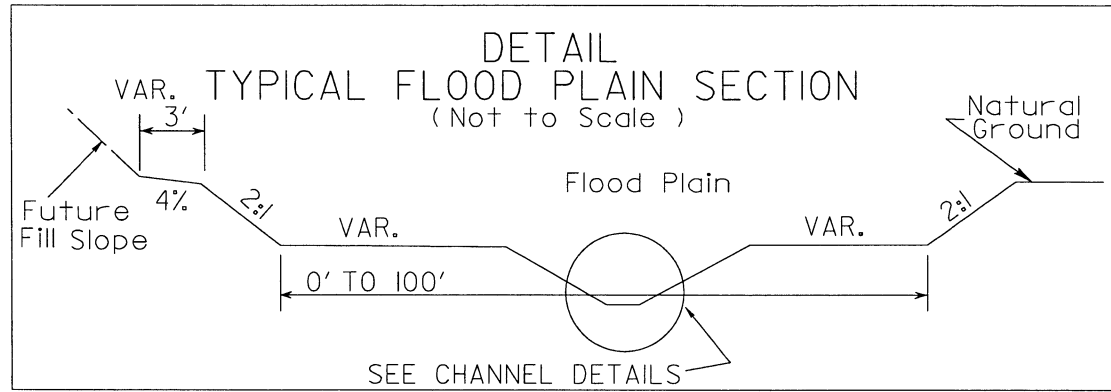
SEGMENT #|

STA. 12+02 TO 14+52 -Y2- LEFT

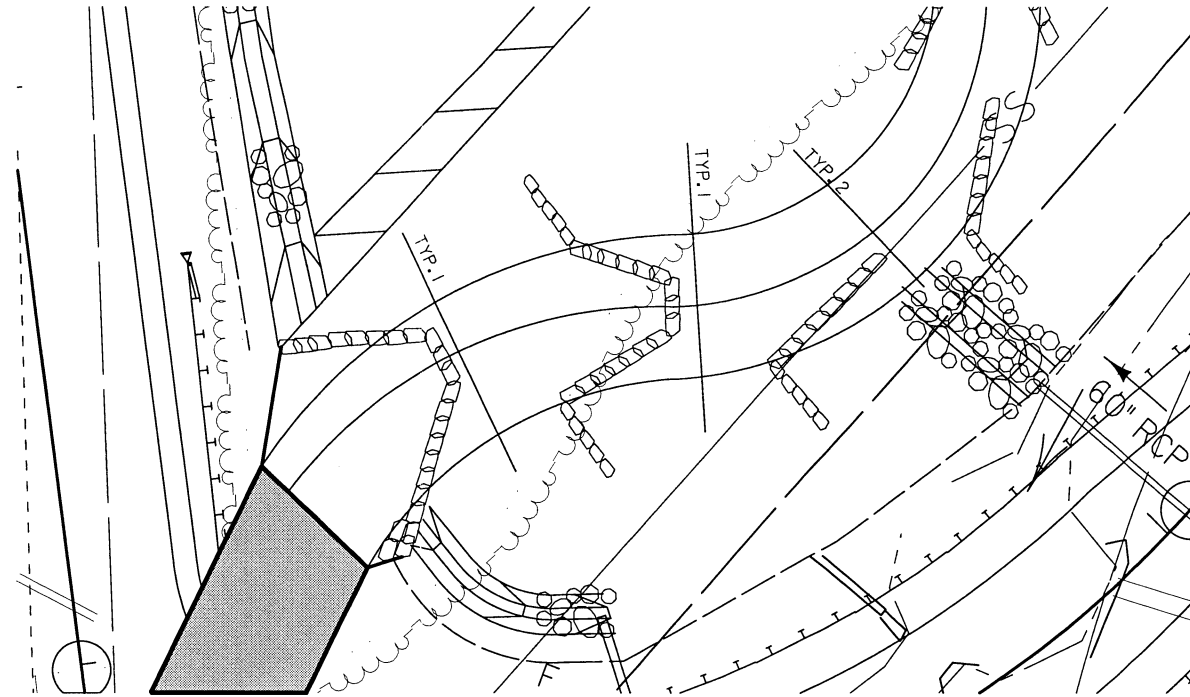
NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE

Sheet 22 of 31



QUANTITIES
 DDE = 3300CY
 BOULDERS = 100@4000LB.
 20@2000LB.
 COIR FIBER MAT = 120SY
 GEOTEXTILE FABRIC = 90SY



CHANNEL PLAN VIEW

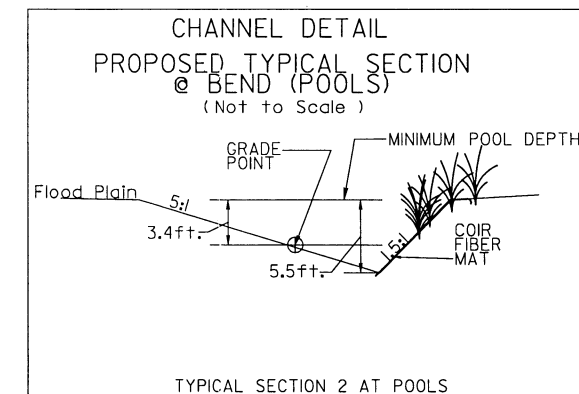
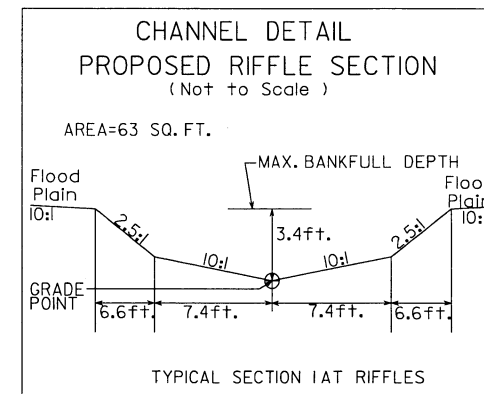
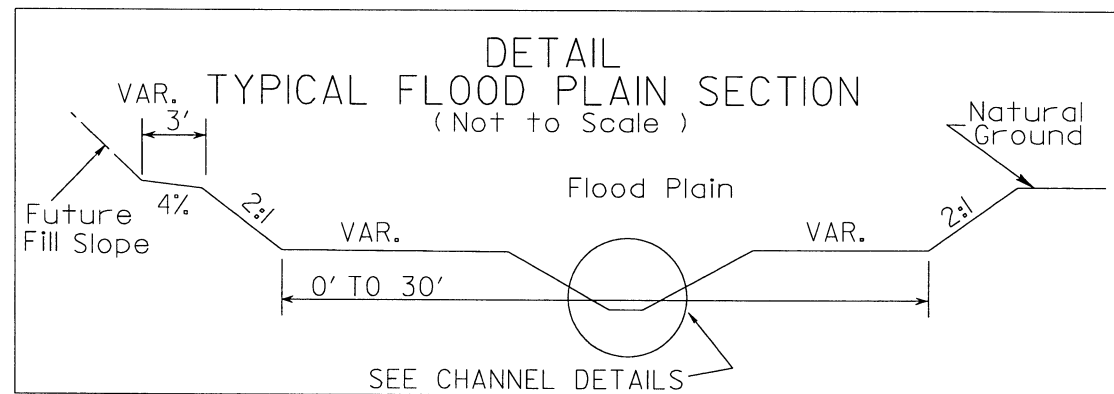
SEGMENT #2

STA. 10+35.6 TO 12+02 -Y2- LEFT

NATURAL CHANNEL DESIGN TYPICALS

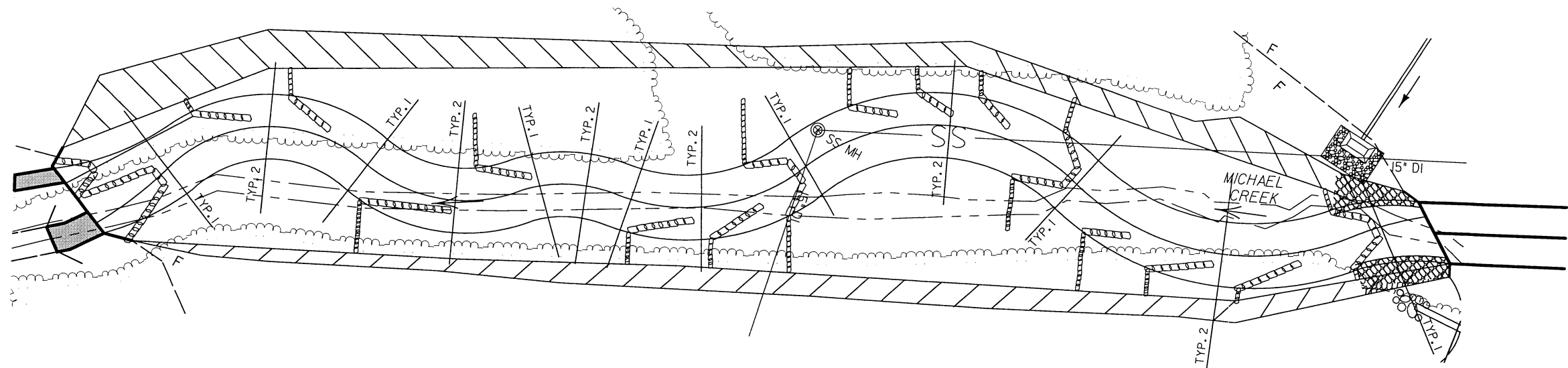
NOT TO SCALE

Sheet 23 of 31



QUANTITIES

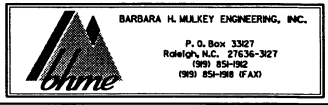
DDE = 14500CY
 BOULDERS = 300@4000LB.
 270@2000LB.
 COIR FIBER MAT = 850SY
 GEOTEXTILE FABRIC = 600SY



CHANNEL PLAN VIEW

SEGMENT #3

STA. 21+45 TO 25+93.3 -YI- RIGHT



PROJECT REFERENCE NO.		SHEET NO.
B-3157		
HYDRAULICS ENGINEER	HIGHWAY DESIGN ENGINEER	
<div>PRELIMINARY PLANS</div> <div>DO NOT USE FOR R/W ACQUISITION</div> <div>INCOMPLETE PLANS</div> <div>DO NOT USE FOR CONSTRUCTION</div>		

Sheet 24 of 31

SEGMENT #3

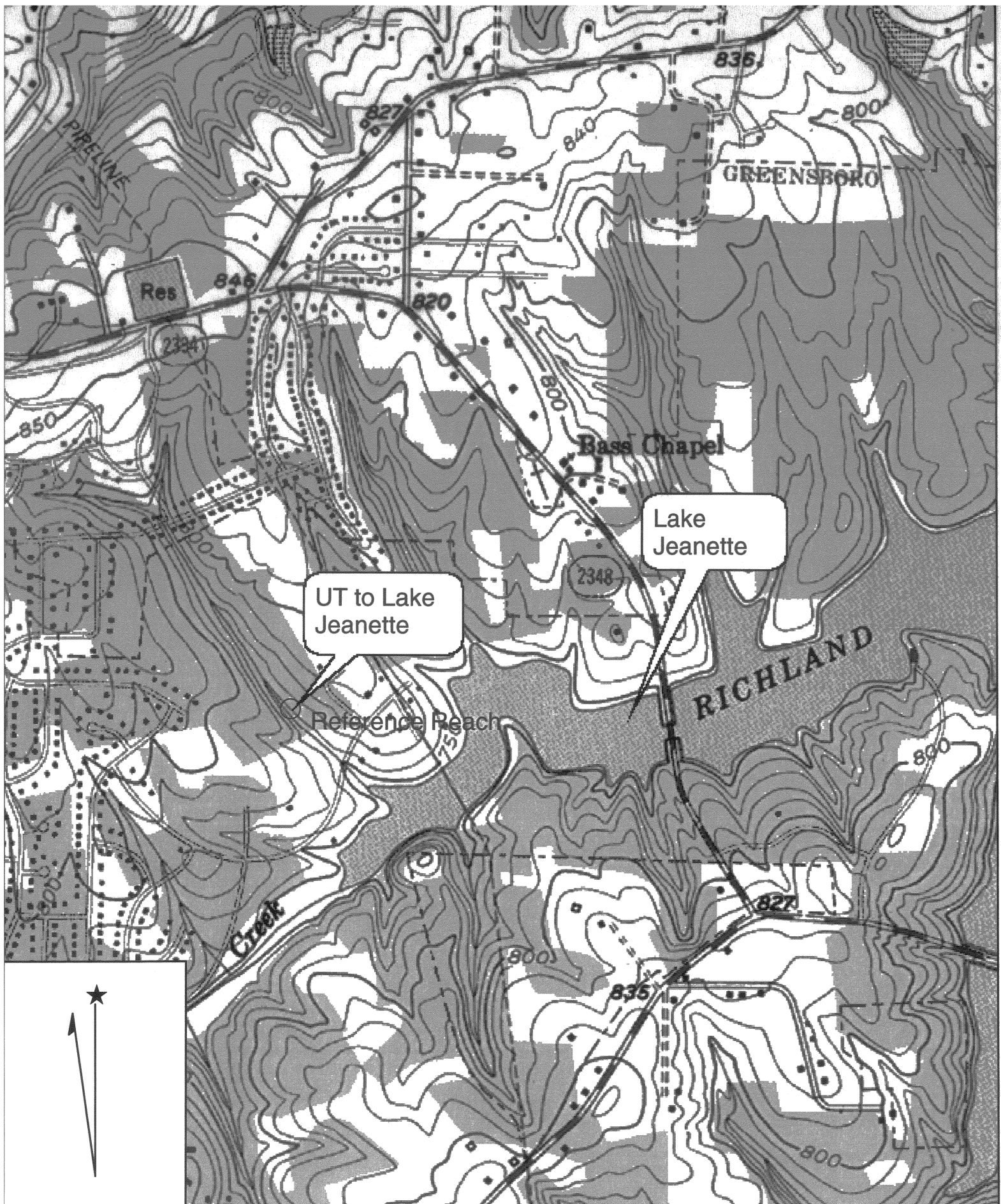
	STA. (-Y1-)	OFFSET	Rc	Lc	GRADE POINT ELEVATION	BANKFULL ELEVATION
PC	21+45.0	95.1' RT			710.60'	712.90'
PI	21+59.8	98.2' RT	130.0'	30.9'		
PT	21+75.3	97.6' RT			710.40'	712.70'
PC	21+75.3	97.6' RT			710.40'	712.70'
PI	22+41.8	96.1' RT	100.0'	117.5'		
PT	22+66.4	157.2' RT			710.25'	712.55'
PC	22+66.4	157.2' RT			710.25'	712.55'
PI	22+95.7	218.9' RT	80.0'	114.2'		
PT	23+56.7	197.7' RT			710.00'	712.30'
PC	23+56.7	197.7' RT			710.00'	712.30'
PI	23+92.8	190.1' RT	75.0'	72.8'		
PT	24+18.5	218.2' RT			709.70'	712.00'
PC	24+18.5	218.2' RT			709.70'	712.00'
PI	24+30.6	231.9' RT	55.0'	36.5'		
PT	24+47.8	234.7' RT			709.60'	711.90'
PC	24+47.8	234.7' RT			709.60'	711.90'
PI	24+79.9	237.1' RT	60'	63.5'		
PT	24+93.3	269.0' RT			709.40'	711.70'
PC	24+93.3	269.0' RT			709.40'	711.70'
PI	25+10.4	320.3' RT	55.0'	86.2'		
PT	25+56.4	302.0' RT			709.15'	711.45'
PC	25+56.4	302.0' RT			709.15'	711.45'
PI	25+80.0	297.4' RT	150.0'	33.8'		
PT	25+86.1	296.6' RT			709.00'	711.30'

SEGMENT #1

	STA. (-Y2-)	OFFSET	Rc	Lc	GRADE POINT ELEVATION	BANKFULL ELEVATION
PC	14+37.6	47.0' RT			715.5'	717.8'
PI	13+99.6	43.2' RT	126.5'	100.4'		
PT	13+73.4	84.9' RT			714.6'	716.9'
PC	13+73.4	84.9' RT			714.6'	716.9'
PI	13+16.0	165.3' RT	77.5'	140.4'		
PT	12+51.6	90.3' RT			713.4'	715.7'
PC	12+51.6	90.3' RT			713.4'	715.7'
PI	12+11.8	47.0' RT	55.7'	86.8'		
PT	11+45.0	84.0' RT			712.6'	714.9'

SEGMENT #2

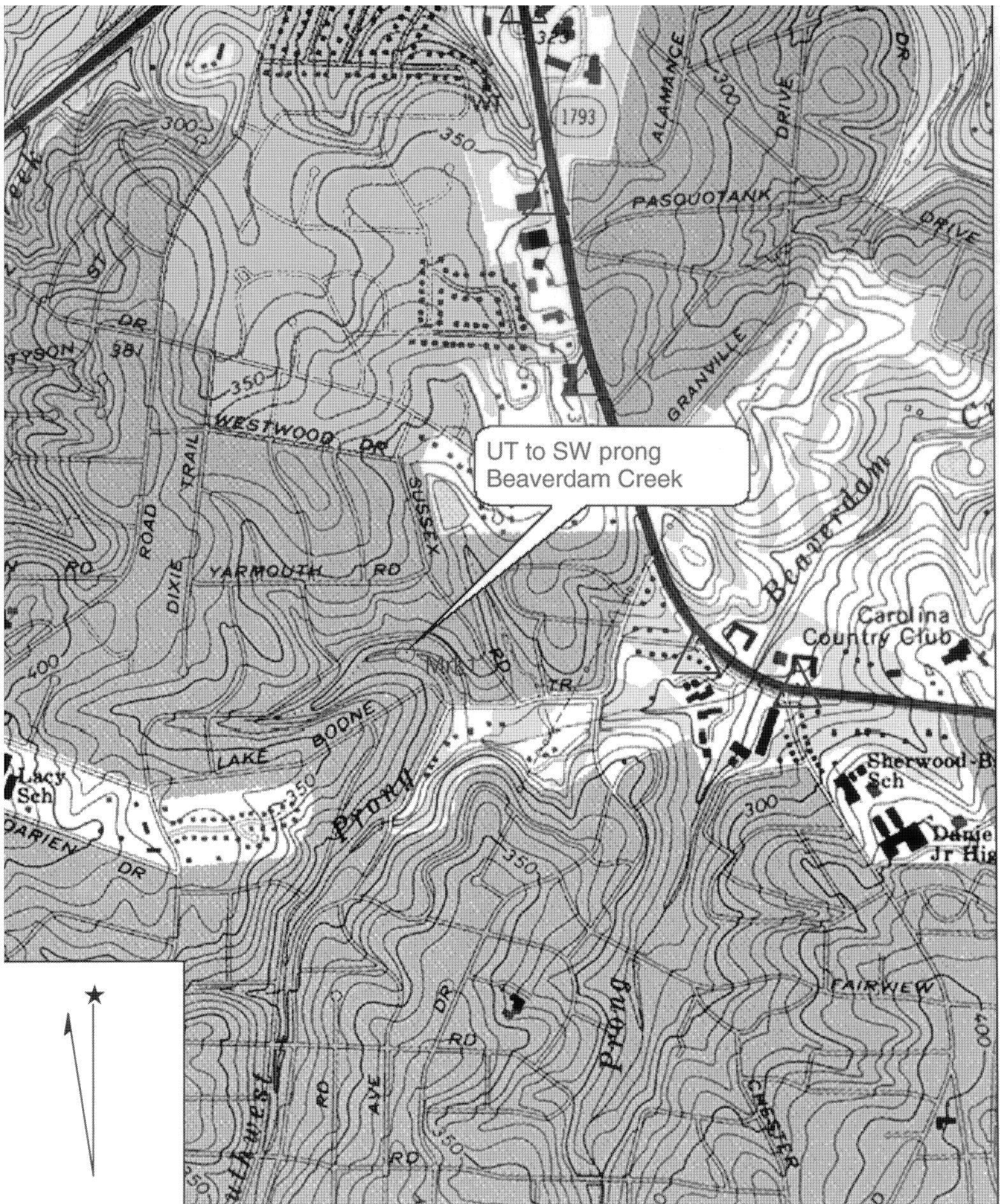
	STA. (-Y2-)	OFFSET	Rc	Lc	GRADE POINT ELEVATION	BANKFULL ELEVATION
PC	14+45.0	84.0' RT			712.6'	714.9'
PI	10+73.6	99.4' RT	80.0'	76.3'		
PT	10+35.6	68.4' RT			712.0'	714.3'



Name: LAKE BRANDT
Date: 11/4/2003
Scale: 1 inch equals 1000 feet

Location: 036° 09' 10.50" N 079° 49' 02.83" W

Sheet 25 of 31



Name: RALEIGH WEST
Date: 11/4/2003
Scale: 1 inch equals 1000 feet

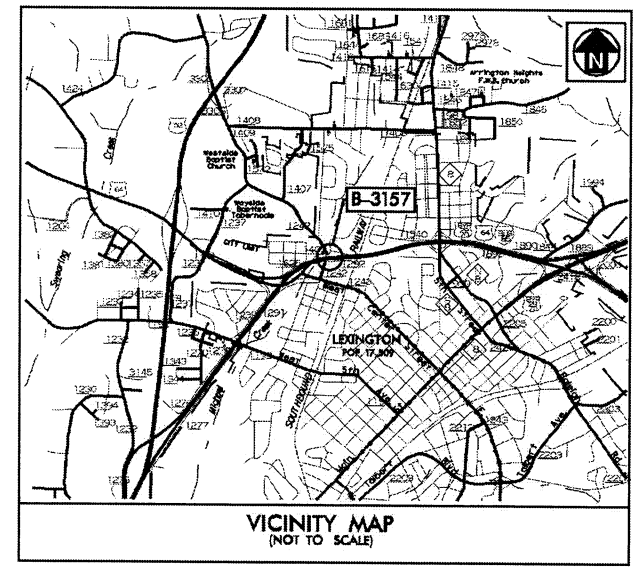
Location: 035° 49' 05.61" N 078° 40' 05.31" W

Sheet 26 of 31

B-3157

PROJECT: 8.1601402

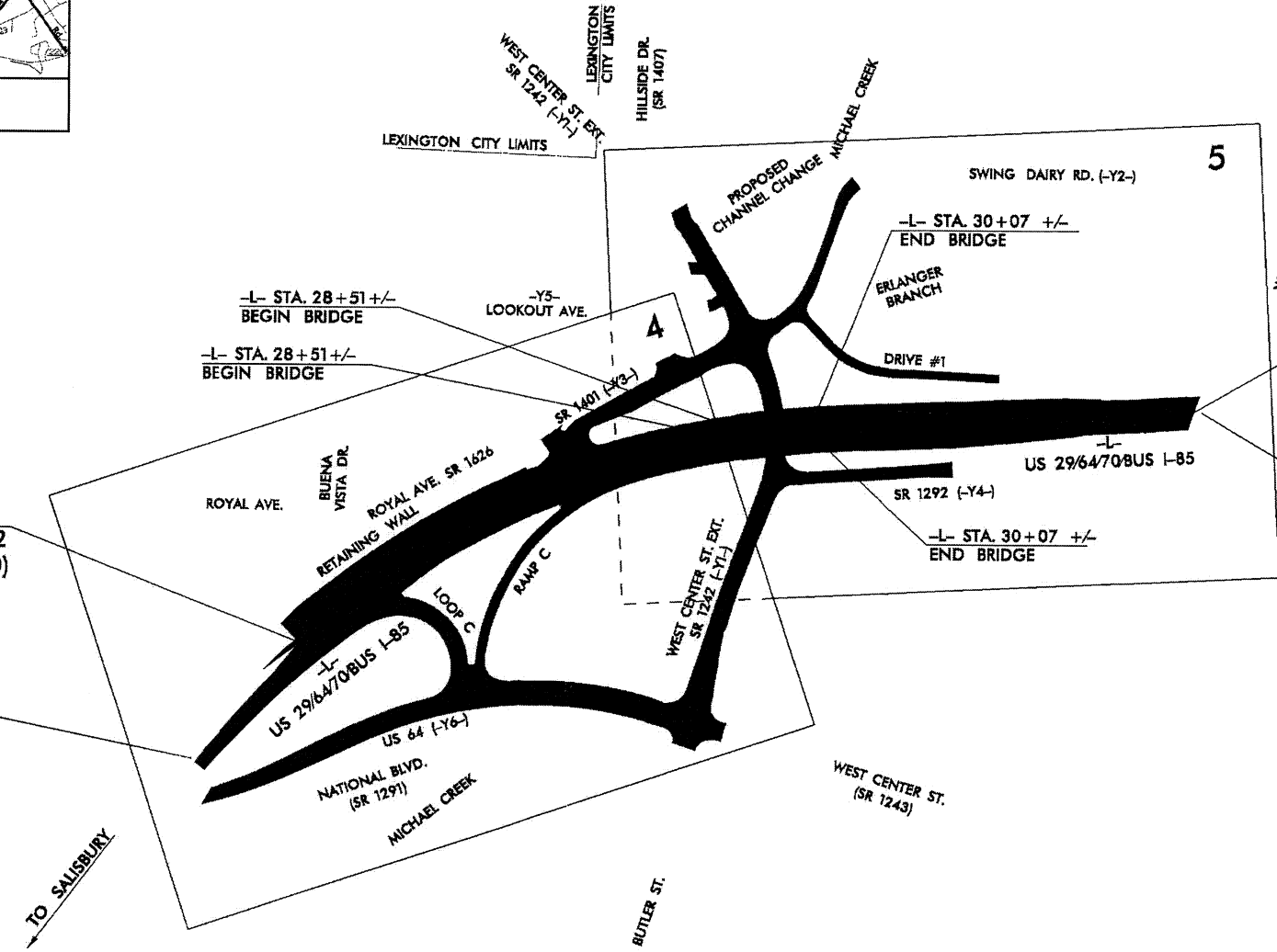
See Sheet 1-A For Index of Sheets
See Sheet 1-B For Conventional Symbols



VICINITY MAP
(NOT TO SCALE)

STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS DAVIDSON COUNTY

LOCATION: BRIDGE NOS. 74 AND 76 OVER SR 1242 AND MICHAEL CREEK
AND APPROACHES ON US 29/64/70 & I-85 BUSINESS
TYPE OF WORK: GRADING, PAVING, DRAINAGE, GUARDRAIL, CULVERTS, STRUCTURES, AND SIGNING

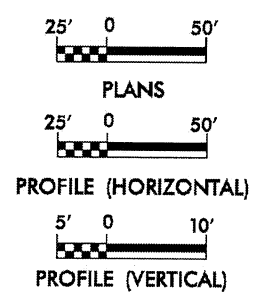


STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	8.1601402	1	
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
8.1601401	BRSTP-29(10)	P.E.	
8.1601402	BRSTP-29(10)	RW, UTIL	

stream impact drawing
sheet 27 of 31



GRAPHIC SCALE



DESIGN DATA

ADT 2002 = 26,400
ADT 2023 = 42,160
DHV = 10%
D = 60%
T = 9% *
V = 60 mph
* (Duals = 5% + TTST = 4%)

PROJECT LENGTH

LENGTH ROADWAY F.A. PROJECT BRSTP-29(10) = 0.385 MILE
LENGTH STRUCTURES F.A. PROJECT BRSTP-29(10) = 0.030 MILE
TOTAL LENGTH STATE PROJECT 8.1601402 = 0.415 MILE

Prepared In the Office of:
Barbara H. Mulkey Engineering, Inc.
FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
2002 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
SEPTEMBER 20, 2002

LETTING DATE:
JULY 15, 2003

NCDOT CONTACT: **CATHY S. HOUSER, P.E.**
DESIGN SERVICES - PROJECT ENGINEER

T. S. HAYES, PE
ROADWAY DESIGN ENGINEER

STRUCTURE DESIGN ENGINEER

HYDRAULICS ENGINEER

ROADWAY DESIGN

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

**DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA**

STATE HIGHWAY ENGINEER - DESIGN
**DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION**

**APPROVED FOR
DIVISION ADMINISTRATOR**

DATE

ENGLISH

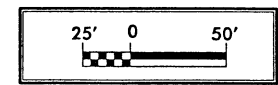


PROJECT REFERENCE NO. B-3157 SHEET NO. 5

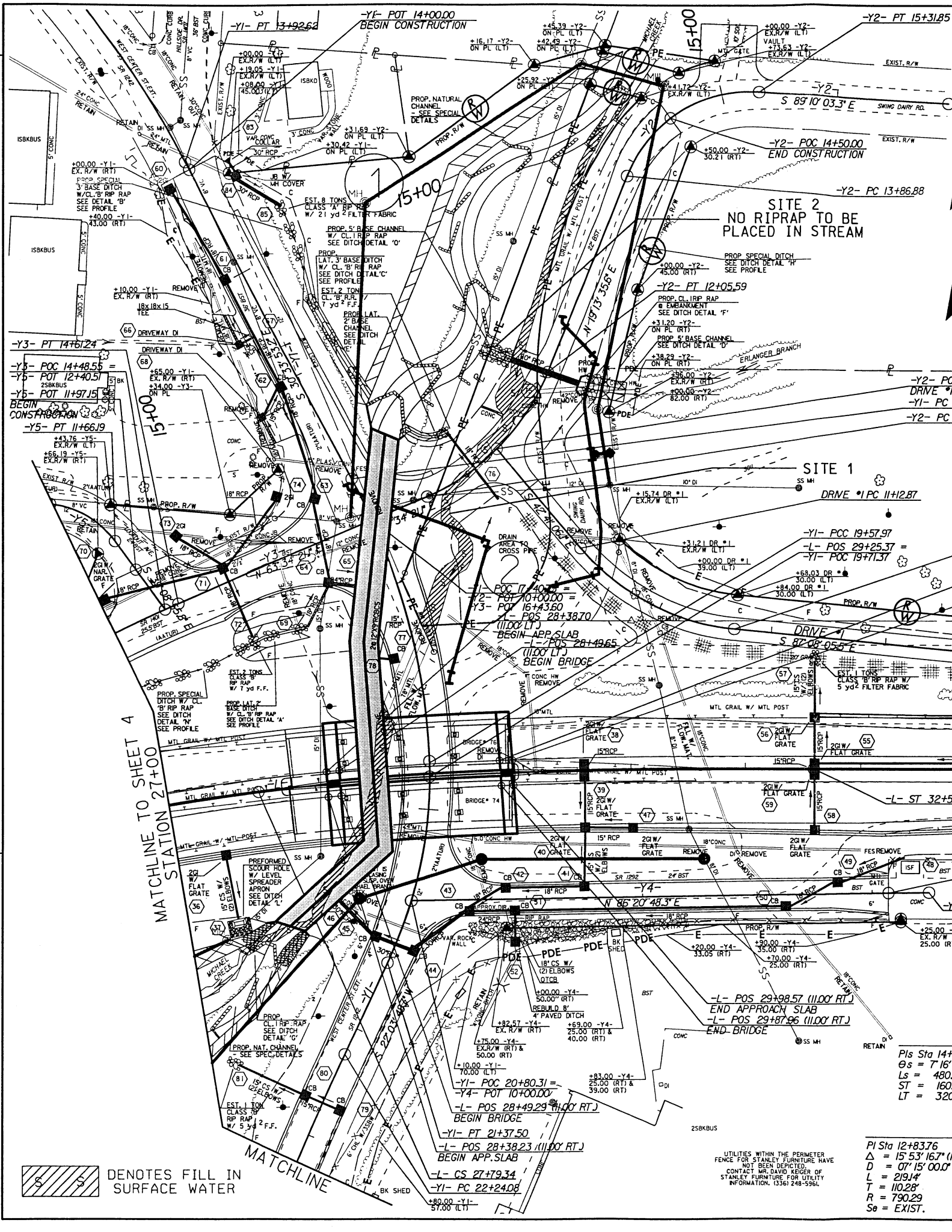
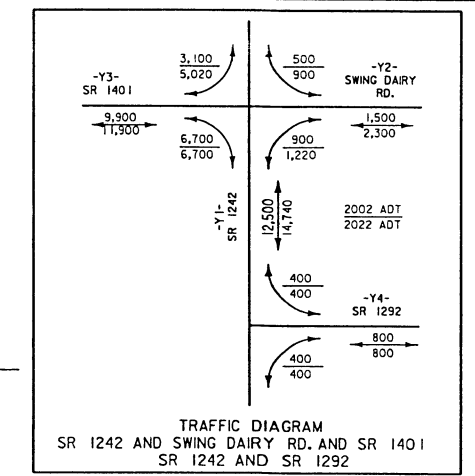
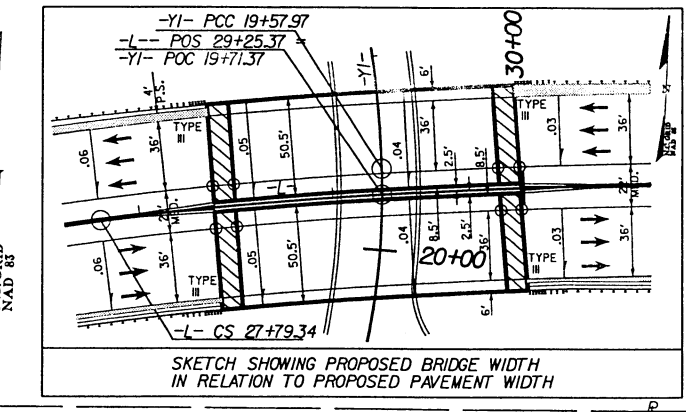
HYDRAULICS ENGINEER ROADWAY DESIGN ENGINEER

stream impact drawing sheet 29 of 31

INCOMPLETE PLANS DO NOT USE FOR CONSTRUCTION



FOR L-1 PROFILE, SEE SHEETS 6 & 7
FOR Y1-1 PROFILE, SEE SHEET 7
FOR Y2-1, Y3-1, Y4-1 & DRIVE 1 PROFILES, SEE SHEET 8
FOR DITCH DETAILS, SEE SHEET 2-1
FOR L-1 CROSS-OVER, SEE SHEETS 2-0 THRU 2-9
FOR Y1-1 & Y3-1 DETOUR, SEE SHEET 2-0
FOR SPECIAL DETAILS OF STRUCTURE ANCHOR UNITS, SEE SHEETS 2-U THRU 2-Y
FOR SPECIAL DETAILS OF PROP. NATURAL CHANNEL, SEE SHEETS 2-J THRU 2-N
FOR SPECIAL DETAIL OF ROCK PLATING, SEE SHEET 2-T
FOR SPECIAL DETAIL OF CONCRETE COVER, SEE SHEET 2-JJ



DRIVE #1		Y1-1		Y2-1		Y3-1		Y4-1	
PI Sta 11+94.59	Δ = 44° 26' 59.4" (LT)	PI Sta 12+83.76	Δ = 15° 53' 16.7" (RT)	PI Sta 18+31.67	Δ = 25° 42' 00.8" (RT)	PI Sta 20+49.42	Δ = 26° 55' 41.0" (RT)	PI Sta 23+88.95	Δ = 07° 24' 30.8" (LT)
Δ = 44° 26' 59.4" (LT)		Δ = 15° 53' 16.7" (RT)		Δ = 25° 42' 00.8" (RT)		Δ = 26° 55' 41.0" (RT)		Δ = 07° 24' 30.8" (LT)	
D = 28° 38' 52.4"		D = 480.00'		D = 10° 00' 00.0"		D = 10° 00' 00.0"		D = 15° 00' 00.0"	
L = 155.16'		L = 219.4'		L = 257.00'		L = 179.52'		L = 329.27'	
T = 81.72'		T = 110.28'		T = 130.70'		T = 91.45'		T = 164.86'	
R = 200.00'		R = 790.29'		R = 572.96'		R = 381.97'		R = 254.48'	
Se = NC		Se = EXIST.		Se = 0.04		Se = 0.04		Se = EXIST.	

Y1-1		Y2-1		Y3-1		Y4-1	
PI Sta 11+94.59	Δ = 44° 26' 59.4" (LT)	PI Sta 12+83.76	Δ = 15° 53' 16.7" (RT)	PI Sta 18+31.67	Δ = 25° 42' 00.8" (RT)	PI Sta 20+49.42	Δ = 26° 55' 41.0" (RT)
Δ = 44° 26' 59.4" (LT)		Δ = 15° 53' 16.7" (RT)		Δ = 25° 42' 00.8" (RT)		Δ = 26° 55' 41.0" (RT)	
D = 28° 38' 52.4"		D = 480.00'		D = 10° 00' 00.0"		D = 10° 00' 00.0"	
L = 155.16'		L = 219.4'		L = 257.00'		L = 179.52'	
T = 81.72'		T = 110.28'		T = 130.70'		T = 91.45'	
R = 200.00'		R = 790.29'		R = 572.96'		R = 381.97'	
Se = NC		Se = EXIST.		Se = 0.04		Se = 0.04	

Y2-1		Y3-1		Y4-1	
PI Sta 11+94.59	Δ = 44° 26' 59.4" (LT)	PI Sta 12+83.76	Δ = 15° 53' 16.7" (RT)	PI Sta 18+31.67	Δ = 25° 42' 00.8" (RT)
Δ = 44° 26' 59.4" (LT)		Δ = 15° 53' 16.7" (RT)		Δ = 25° 42' 00.8" (RT)	
D = 28° 38' 52.4"		D = 480.00'		D = 10° 00' 00.0"	
L = 155.16'		L = 219.4'		L = 257.00'	
T = 81.72'		T = 110.28'		T = 130.70'	
R = 200.00'		R = 790.29'		R = 572.96'	
Se = NC		Se = EXIST.		Se = 0.04	

Y3-1		Y4-1	
PI Sta 11+94.59	Δ = 44° 26' 59.4" (LT)	PI Sta 12+83.76	Δ = 15° 53' 16.7" (RT)
Δ = 44° 26' 59.4" (LT)		Δ = 15° 53' 16.7" (RT)	
D = 28° 38' 52.4"		D = 480.00'	
L = 155.16'		L = 219.4'	
T = 81.72'		T = 110.28'	
R = 200.00'		R = 790.29'	
Se = NC		Se = EXIST.	

Y4-1	
PI Sta 11+94.59	Δ = 44° 26' 59.4" (LT)
Δ = 44° 26' 59.4" (LT)	
D = 28° 38' 52.4"	
L = 155.16'	
T = 81.72'	
R = 200.00'	
Se = NC	

DENOTES FILL IN SURFACE WATER

SS DENOTES FILL IN SURFACE WATER

MULKEY
ENGINEERS & CONSULTANTS
PO BOX 82187
DALLAS, TEXAS 75282
TEL 972-331-1111
FAX 972-331-1112
WWW.MULKEYENGINEERS.COM

PROJECT REFERENCE NO. B-3157 SHEET NO. 4
HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER
stream impact drawing
Sheet 30 of 31
INCOMPLETE PLANS
DO NOT USE FOR CONSTRUCTION

ENGLISH

MATCHLINE TO SHEET 5
STATION 27+00

MATCHLINE

MATCHLINE

Pls Sta 14+68.96
 $\theta_s = 7' 16'' 32.4''$
 $L_s = 480.00'$
 $ST = 160.25'$
 $LT = 320.27'$
 $R = 1890.00'$
 $S_e = 0.06$

Pls Sta 22+22.47
 $\Delta = 34' 52'' 55.7''$ (RT)
 $D = 0' 30'' 53.5''$
 $L = 150.65'$
 $T = 693.78'$
 $R = 1890.00'$
 $S_e = 0.06$

Pls Sta 29+39.58
 $\theta_s = 7' 16'' 32.4''$
 $L_s = 480.00'$
 $ST = 160.25'$
 $LT = 320.27'$
 $R = 1890.00'$
 $S_e = 0.06$

Pls Sta 11+92.38
 $\Delta = 25' 58'' 44.3''$ (RT)
 $D = 8' 5'' 04.0''$
 $L = 31.74'$
 $T = 16.15'$
 $R = 70.00'$
 $S_e = NC$

Pls Sta 14+26.76
 $\Delta = 02' 45'' 33.6''$ (RT)
 $D = 0' 40'' 00.0''$
 $L = 68.98'$
 $T = 34.50'$
 $R = 1432.39'$
 $S_e = NC$

Pls Sta 24+55.50
 $\Delta = 10' 23'' 06.6''$ (LT)
 $D = 2' 15'' 00.0''$
 $L = 46.56'$
 $T = 23.42'$
 $R = 2546.48'$
 $S_e = EXIST$

Pls Sta 27+66.75
 $\Delta = 8' 05'' 50.0''$ (RT)
 $D = 5' 00'' 00.0''$
 $L = 161.94'$
 $T = 81.11'$
 $R = 1145.92'$
 $S_e = EXIST$

Pls Sta 1+00.24
 $\theta_s = 12' 02'' 40.3''$
 $L_s = 168.00'$
 $ST = 68.34'$
 $LT = 100.24'$
 $\Delta_1 = 3' 05'' 19.4''$
 $\Delta_2 = 11' 15'' 00.0''$
 $R_1 = 1855.00'$
 $R_2 = 509.30'$

Pls Sta 4+80.12
 $\Delta = 63' 00'' 13.5''$ (RT)
 $D = 11' 15'' 00.0''$
 $L = 560.03'$
 $T = 312.12'$
 $R = 509.30'$
 $S_e = 0.06$

Pls Sta 0+93.89
 $\theta_s = 38' 11'' 49.9''$
 $L_s = 144.00'$
 $ST = 52.95'$
 $LT = 93.89'$
 $\Delta_1 = 3' 05'' 19.4''$
 $\Delta_2 = 38' 11'' 49.9''$
 $R_1 = 1855.00'$
 $R_2 = 150.00'$

Pls Sta 3+17.06
 $\Delta = 98' 09'' 52.6''$ (RT)
 $D = 38' 11'' 49.9''$
 $L = 256.99'$
 $T = 173.06'$
 $R = 150.00'$
 $S_e = 0.06$

TRAFFIC DIAGRAM
SR 1401 AND US 29/64/70/BUS 85

TRAFFIC DIAGRAM
US 26/64/70/BUS 85
SR 1401 AND US 29/64/70/BUS 85

-L- POC 17+00.00
BEGIN STATE PROJECT B-3157

-L- POS 13+35.00
BEGIN CONSTRUCTION

Y6- POC 12+44.81
BEGIN CONSTRUCTION

TRAFFIC DIAGRAM
US 64 AND RAMP C/LOOP C
SR 1242 AND US 64 AND SR 1243 AND BUTLER ST.

Pls Sta 11+71.06
 $\Delta = 20' 19'' 25.3''$ (LT)
 $D = 6' 00'' 00.0''$
 $L = 338.73'$
 $T = 171.16'$
 $R = 954.93'$
 $S_e = EXIST$

Pls Sta 13+98.78
 $\theta_s = 05' 24'' 00.0''$
 $L_s = 180.00'$
 $ST = 60.05'$
 $LT = 120.06'$

Pls Sta 16+38.78
 $\theta_s = 05' 24'' 00.0''$
 $L_s = 180.00'$
 $ST = 60.05'$
 $LT = 120.06'$

Pls Sta 20+13.39
 $\Delta = 26' 28'' 30.0''$ (RT)
 $D = 6' 00'' 00.0''$
 $L = 607.92'$
 $T = 314.66'$
 $R = 954.93'$
 $S_e = 0.04$

Y6- POT 24+09.92 =
Y1- POC 26+78.32
Y6- PRC 26+85.65

Y6- PT 23+06.64

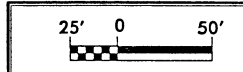
Y1- POC 27+30.00
END CONSTRUCTION

10/28/2003 10:25:39 PM
F:\Hydro\Projects\B-3157\Sheet30.dgn

ENGLISH

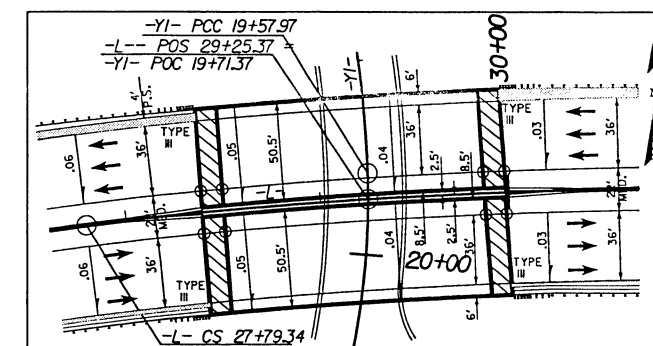
MULKEY
ENGINEERS & CONSULTANTS
PO BOX 21817
BIRMINGHAM, AL 35201
205 975-1111 FAX
WWW.MULKEYINC.COM

PROJECT REFERENCE NO. B-3157 SHEET NO. 5
HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER
stream Impact Analysis
Sheet 31 of 31
INCOMPLETE PLANS
DO NOT USE FOR CONSTRUCTION

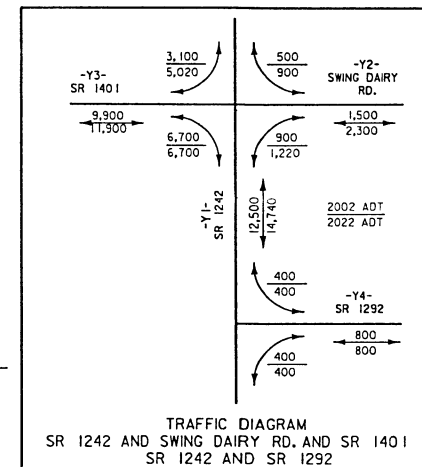


FOR -L- PROFILE, SEE SHEETS 6 & 7
FOR -Y1- PROFILE, SEE SHEET 7
FOR -Y2-, -Y3-, -Y4- & DRIVE I PROFILES, SEE SHEET 8
FOR DITCH DETAILS, SEE SHEET 2-1
FOR -L- CROSS-OVERS, SEE SHEETS 2-0 THRU 2-0
FOR -Y1- & -Y3- DETOURS, SEE SHEET 2-R
FOR SPECIAL DETAILS OF STRUCTURE ANCHOR UNITS, SEE SHEETS 2-U THRU 2-Y
FOR SPECIAL DETAILS OF PROP. NATURAL CHANNEL, SEE SHEETS 2-J THRU 2-N
FOR SPECIAL DETAIL OF ROCK PLATING, SEE SHEET 2-T
FOR SPECIAL DETAIL OF CONCRETE COVER, SEE SHEET 2-JJ

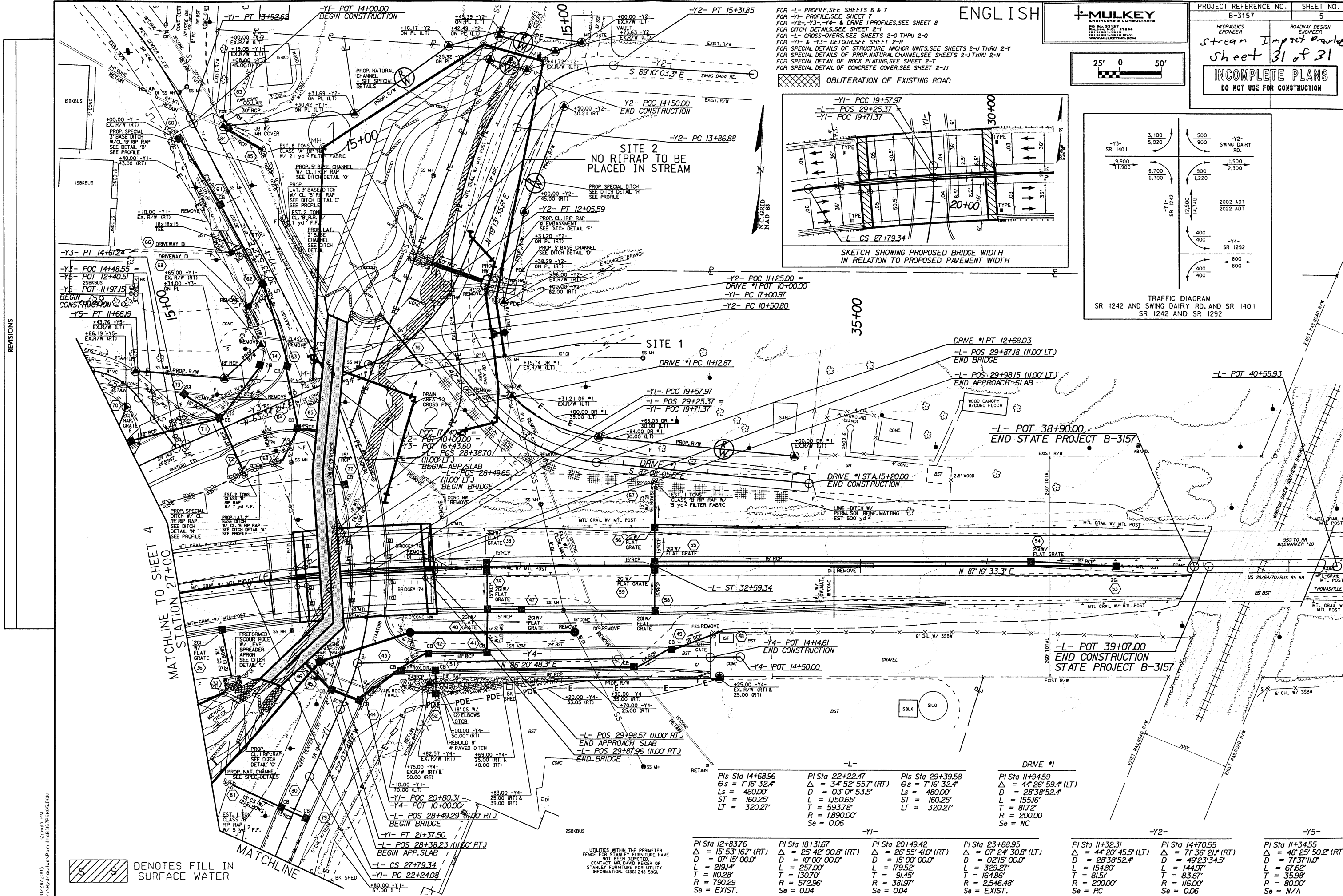
OBUTERATION OF EXISTING ROAD



SKETCH SHOWING PROPOSED BRIDGE WIDTH IN RELATION TO PROPOSED PAVEMENT WIDTH



TRAFFIC DIAGRAM
SR 1242 AND SWING DAIRY RD. AND SR 1401
SR 1242 AND SR 1292



REVISIONS

MATCHLINE TO SHEET 4
STATION 27+00

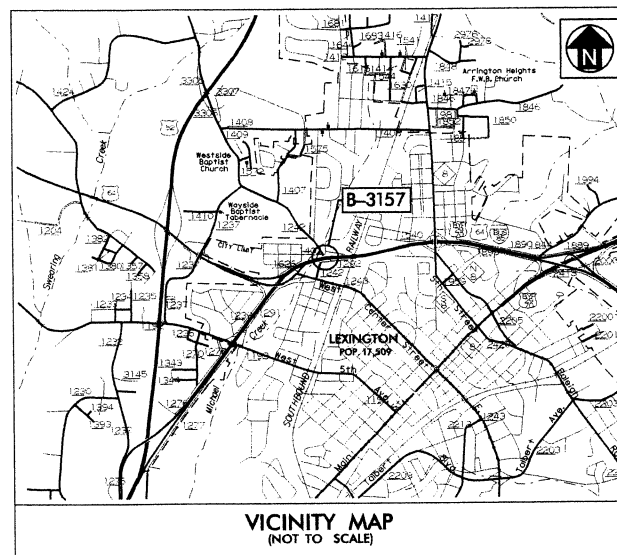
MATCHLINE

5 DENOTES FILL IN SURFACE WATER

UTILITIES WITHIN THE PERIMETER FENCE FOR STANLEY FURNITURE HAVE NOT BEEN DEPICTED
CONTACT MR. DAVID KEEGER OF STANLEY FURNITURE FOR UTILITY INFORMATION. (336) 248-5961

-L-		DRIVE #1		-Y1-		-Y2-		-Y3-		-Y4-		-Y5-	
Pls Sta 14+68.96	Pls Sta 22+22.47	Pls Sta 29+39.58	Pls Sta 11+94.59	Pls Sta 12+83.76	Pls Sta 18+31.67	Pls Sta 20+49.42	Pls Sta 23+88.95	Pls Sta 11+32.31	Pls Sta 14+70.55	Pls Sta 11+34.55			
Δ = 15° 53' 16.7" (RT)	Δ = 34° 52' 55.7" (RT)	Δ = 26° 55' 41.0" (RT)	Δ = 44° 26' 59.4" (LT)	Δ = 15° 53' 16.7" (RT)	Δ = 25° 42' 00.8" (RT)	Δ = 15° 00' 00.0" (RT)	Δ = 07° 24' 30.8" (LT)	Δ = 44° 20' 45.5" (LT)	Δ = 71° 36' 21.1" (RT)	Δ = 48° 25' 50.2" (RT)			
Ls = 480.00'	D = 03° 01' 53.5"	Ls = 480.00'	D = 28° 38' 52.4"	Ls = 480.00'	D = 10° 00' 00.0"	D = 15° 00' 00.0"	D = 02° 15' 00.0"	D = 28° 38' 52.4"	D = 49° 23' 34.5"	D = 71° 37' 11.0"			
ST = 160.25'	L = 1150.65'	L = 1150.65'	L = 1551.6'	ST = 160.25'	L = 257.00'	L = 179.52'	L = 329.27'	L = 154.80'	L = 144.97'	L = 67.62'			
LT = 320.27'	T = 593.78'	T = 91.45'	T = 81.72'	T = 110.28'	T = 130.70'	T = 164.86'	T = 164.86'	T = 81.57'	T = 81.57'	T = 35.98'			
	R = 1890.00'	R = 381.97'	R = 200.00'	R = 790.29'	R = 572.96'	R = 381.97'	R = 2546.48'	R = 200.00'	R = 116.00'	R = 80.00'			
	Se = 0.06	Se = 0.04	Se = 0.04	Se = EXIST.	Se = 0.04	Se = 0.04	Se = EXIST.	Se = RC	Se = 0.06	Se = N/A			

TIP: B-3157

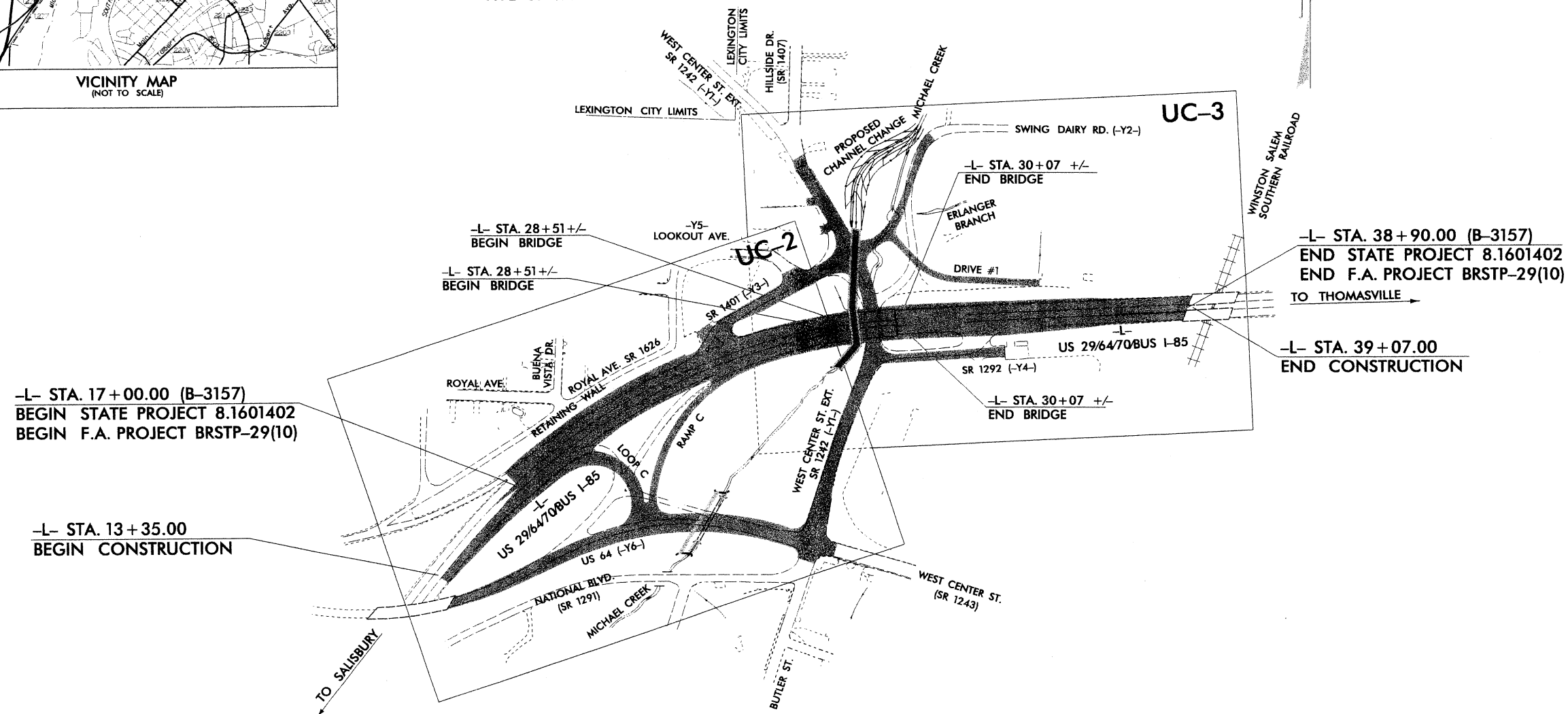


STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

UTILITY CONSTRUCTION PLANS DAVIDSON COUNTY

LOCATION: BRIDGE NOS. 74 AND 76 OVER SR 1242 AND MICHAEL CREEK
AND APPROACHES ON US 29/64/70 & I-85 BUSINESS

TYPE OF WORK: WATER LINE AND SEWER LINE RELOCATION AND SEWER LINE CONSTRUCTION



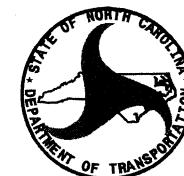
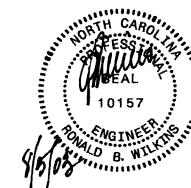
INDEX OF SHEETS

SHEET NO.	DESCRIPTION
UC-1	TITLE SHEET
UC-2 THRU UC-3	UTILITY CONSTRUCTION PLAN SHEETS
UC-4 THRU UC-6	PROFILE SHEETS
UC-7 THRU UC-9	DETAILS SHEETS

WATER AND SEWER OWNERS ON PROJECT

- (1) WATER-THE CITY OF LEXINGTON
- (2) SANITARY SEWER-THE CITY OF LEXINGTON

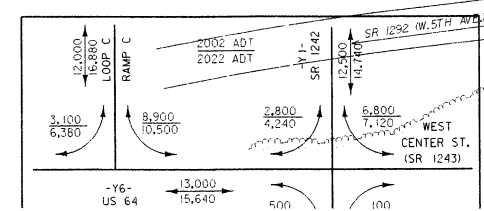
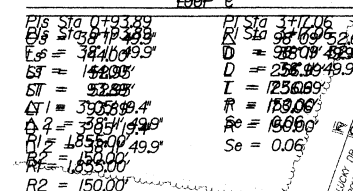
SEAL



PREPARED IN THE OFFICE OF:
DIVISION OF HIGHWAYS
DESIGN SERVICES
UTILITY SECTION

1591 MAIL SERVICES CENTER
RALEIGH NC 27699-1591
PHONE (919) 250-4128
FAX (919) 250-4119

Roger Worthington, P.E. UTILITIES SECTION ENGINEER
R. B. Wilkins, P.E. UTILITIES SQUAD LEADER PROJECT ENGINEER
Steve Godbold UTILITIES PROJECT DESIGNER

[illegible]

This is a detailed aerial map of a residential neighborhood in San Francisco, California. The map shows a grid of streets, including Royal Ave. S. 1st St., Royal Ave. S. 2nd St., and Royal Ave. S. 3rd St. The map also shows several houses, including the 'TRAC HOUSE' and 'K. HOUSE'. A large pool is visible in the center of the map. The map is overlaid with a grid of numbered streets and includes a scale bar indicating distances in feet and meters. The map is titled 'SAN FRANCISCO, CALIF.' and includes a legend for 'STREETS', 'POOLS', and 'HOUSES'.

[illegible]

LOOP C SC I+44.00
 LOOP C CS 0+00 (35.00 RT)=
 -L- POC 17+76.28
 LOOP C PT 4+00.99
 Y6- POC 18+80.00=
 LOOP C POT 4+85.64

[illegible]

TO PROFILE SEE SHEETS 6 & 7
 FOR PROFILE SEE SHEET 7
 FOR TOP OF 2.5 RAMP CLEARANCE SEE SHEET 9
 FOR TOP OF DEVIATORS & RAMP C PROFILES SEE SHEET 9
 FOR CROSS SECTIONAL SLOPE SEE SHEETS 2-0 THRU 2-4
 FOR SPECIAL DETAILS OF SIGNATURE ANCHOR UNITS SEE SHEETS 2-1 THRU 2-4
 FOR SPECIAL DETAILS OF SPECIAL NATURAL CHANNELS SEE SHEETS 2-1 THRU 2-4
 FOR SPECIAL DETAILS OF SPECIAL NATURAL CHANNELS SEE SHEETS 2-1 THRU 2-4
 FOR SPECIAL DETAILS OF SPECIAL NATURAL CHANNELS SEE SHEETS 2-1 THRU 2-4
 FOR SPECIAL DETAILS OF SPECIAL NATURAL CHANNELS SEE SHEETS 2-1 THRU 2-4

[illegible]

PROP. MH "A"
 STA. 0+78.6
 STA. 0+000.0
 STA. 23+26
 OFFSET=119'

INV. 125.86
 INV. 134.21
 05
 04
 03
 02
 01
 F. MONO.
 CONC. ISL.

[illegible][illegible]

22" LINE 2 (4' DIA.)
55 LINE 1=
LINE 2
90 LINE -Y15
55' HT.

EXIST. MH #A1
STA. 0+00.00 L
STA. 23+97.11
OFFSET=146.26'

80P; 40'-16" DI RESTRAINED
JOINT SEWER PIPE, PC 350

(4' DIA)
LINE 1
8 LINE -Y1-
7' RT.

LINE 1

TOP=710.56
 170.75
 2.60 (CM)
 1.50 (CM)
 PROPOSED 4' DIA LINE 1
 EXISTING 4' DIA LINE -Y1-RT

ET UC-3

CHLINE TO SHEE
STATION 27+(

MATCH

**FILED OR
ABANDONED
(IT SEWER)**

00 -Y|-
/W (L T)
7
GH ROAD
URE CORP.
43 PG 82
-X-

PROP. MH "B3" (4' DIA.)
STA. 2+72.04 LINE 3
STA. 14+95.65 LINE -Y1
OFFSET 121.32' RT.

PROP. 492.97' 16" DI
SEWER PIPE, PC 350

PROP. 408'-FILL OR REMOVE
ABANDONED 16" PIPE (DI SEWER)
PROP. 171'-FILL OR REMOVE
ABANDONED 10" PIPE (DI SEWER)
PROP. 3-BREAK DOWN, PLUG &
FILL ABANDONED UTILITY MANHOLE

PROP. 65'-12" DI
RESTRAINED
JOINT WATER
PIPE, CLASS 50
DI BEND

PROP. MH "A3" (4' DIA.)
STA. 0+00.00 LINE 3
STA. 17+81.10 LINE -Y1
OFFSET 15.61' LT.

PROP. 215'-FILL OR
REMOVE ABANDONED
12" PIPE (DI WATER)

PROP. 1-BREAKDOWN
& REBUILD EXISTING
MANHOLE

PROP. 33'-16" DI
SEWER PIPE, PC 350

PROP. MH "D1" (4' DIA.)
STA. 2+69.55 LINE 1
STA. 23+83.01 LINE -Y1
OFFSET 146.26' RT.

PROP. 493.84' 8" DI
SEWER PIPE, PC 350

PROP. MH "B2" (4' DIA.)
STA. 2+45.05 LINE 2
STA. 20+92.11 LINE -Y1
OFFSET 42.69' RT.

PROP. 47'-12" DI WATER LINE, PC 350
PROP. 33'-6" DI WATER LINE, PC 350
PROP. 4'-12" DI 45° BENDS
PROP. 1'-12" X 6" DI TEE
PROP. 1-RELOCATE EXIST. FIRE HYDRANT
PROP. 1-6" GATE VALVE & VALVE BOX, 200# WP

PROP. MH "B4" (4' DIA.)
STA. 0+73.77 LINE 4
STA. 14+59.08 LINE -Y1
OFFSET 26.47' RT.

PROP. 383.71'-10" DI
SEWER PIPE, PC 350
PROP. 40'-10" DI RESTRAINED
JOINT SEWER PIPE, PC 350

PROP. MH "C4" (4' DIA.)
STA. 3+57.11 LINE 4
STA. 11+94.42 LINE -Y1
OFFSET 52.03' RT.

PROP. 290'-8" DI WATER PIPE, PC 350
PROP. 15'-6" DI WATER PIPE, PC 350
PROP. 1-8" X 6" DI TEE
PROP. 1-6" GATE VALVE & VALVE BOX, 200# WP
PROP. 1-RELOCATE EXIST FIRE HYDRANT
PROP. 4-8" 45° DI BEND

EXIST. MH "D4" (4' DIA.)
STA. 4+23.71 LINE 4
STA. 11+57.09 LINE -Y1
OFFSET 94.73' LT.

PROP. 197'-12" DI
WATER PIPE, PC 350
PROP. 1-12" 11 1/4° DI BEND
PROP. 1-12" 90° DI BEND

PROP. 2-BREAKDOWN, PLUG AND
FILL ABANDONED UTILITY MANHOLE

PROP. MH "D2" (4' DIA.)
STA. 5+49.06 LINE 2
STA. 12+55.04 LINE -Y4
OFFSET 32.12

Pls Sta 14+68.96
θs = 7° 16' 32.4"

PI Sta 22+22.47
Δ = 34° 52' 55.7" (RT)
D = 0° 3' 01" 53.5"
L = 1150.65'
T = 593.78'
R = 1890.00'
Se = 0.06

Pls Sta 29+39.58
θs = 7° 16' 32.4"
Ls = 480.00'
ST = 160.25'
LT = 320.27'

DRIVE "I"
PI Sta 11+94.59
STANLEY INTERCHG. (LT)
DB 80' 4" 38' 52.4"
L = 155.16'
T = 81.72'
R = 200.00'
Se = NC

PI Sta 18+31.67
Δ = 25° 42' 00.8" (RT)
D = 10° 00' 00.0"
L = 257.00'
T = 130.70'
R = 572.96'
Se = 0.04

PI Sta 20+49.42
Δ = 26° 55' 4.0" (RT)
D = 15° 00' 00.0"
L = 179.52'
T = 91.45'
R = 381.97'
Se = 0.04

PI Sta 23+88.95
Δ = 07° 24' 30.8" (LT)
D = 02° 15' 00.0"
L = 329.27'
T = 164.86'
R = 2546.48'
Se = EXIST

PI Sta 11+43.31
Δ = 44° 20' 45.5" (LT)
D = 28° 38' 52.4"
L = 154.80'
T = 81.51'
R = 200.00'
Se = RP

PI Sta 14+70.55
Δ = 71° 36' 21.1" (RT)
D = 49° 23' 34.5"
L = 144.91'
T = 83.67'
R = 116.00'
Se = 0.06

PI Sta 11+34.55
Δ = 48° 25' 50.2" (RT)
D = 71° 37' 11.0"
L = 67.62'
T = 35.98'
R = 80.00'
Se = N/A

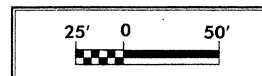
SMITH, SMITH, SMITH, & SMITH
PB 5 PG 99

DESIGNED BY: CSG
DRAWN BY: CSG
CHECKED BY: RBW
APPROVED BY: RBW
REVISED:
NORTH CAROLINA
DEPARTMENT OF
TRANSPORTATION
DESIGN SERVICES UNIT
PHONE: (919) 250-4128
FAX: (919) 250-4119


UTILITY CONSTRUCTION
PLANS ONLY

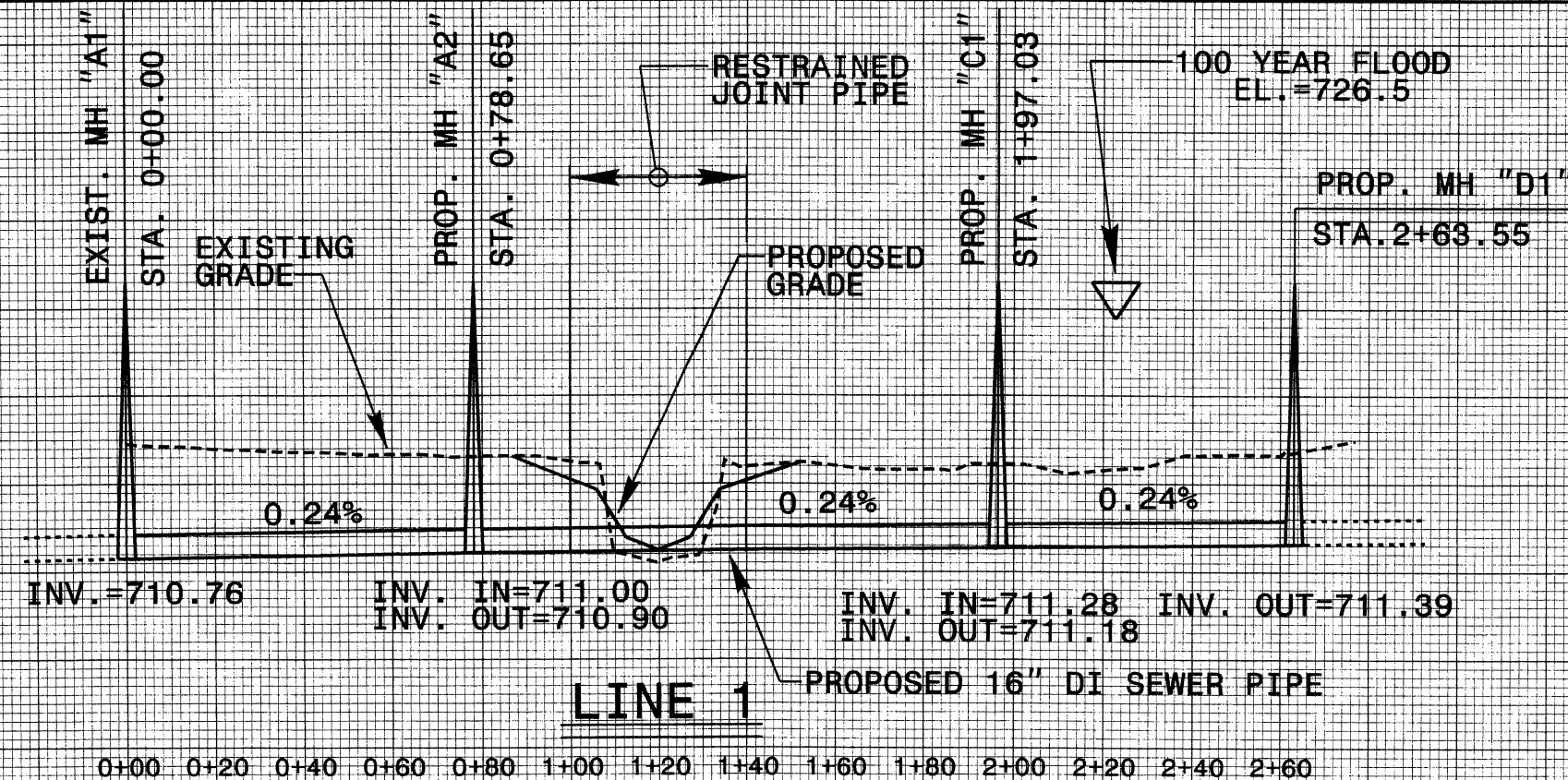
10157

ENGINEER
RONALD B. WILSON

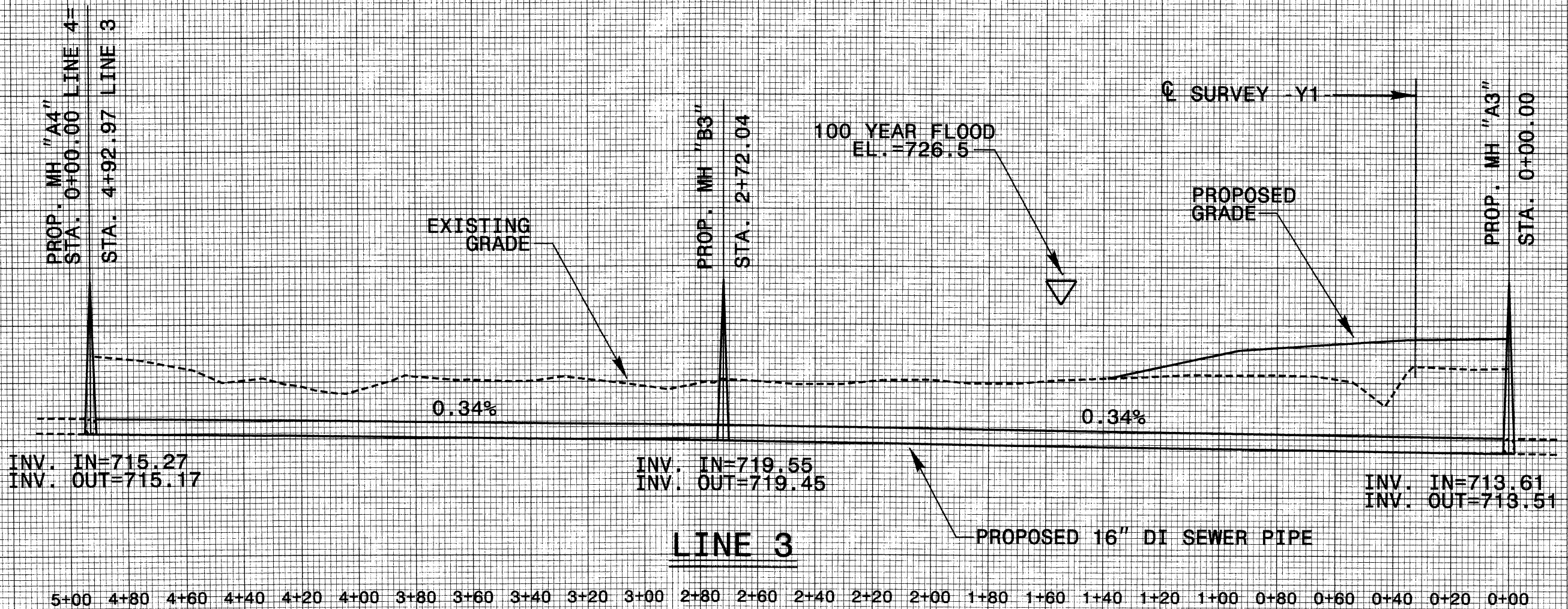


5/14/99

PROJECT REFERENCE NO.		SHEET NO.	
B-3157		UC-4	
DESIGNED BY:	CSG		
DRAWN BY:	CSG		
CHECKED BY:	RBW		
APPROVED BY:	RBW		
REVISED:			
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION		ENGINEER DONALD B. WILKINS	
DESIGN SERVICES UNIT PHONE: (919) 250-4128 FAX: (919) 250-4119		UTILITY CONSTRUCTION PLANS ONLY	



UTILITY CONSTRUCTION



LINE 3

PROPOSED 16" DI SEWER PIPE

00-AUG-2003 08:02
\\nct\projects\B3157\B3157_P01\ut_wor.dgn
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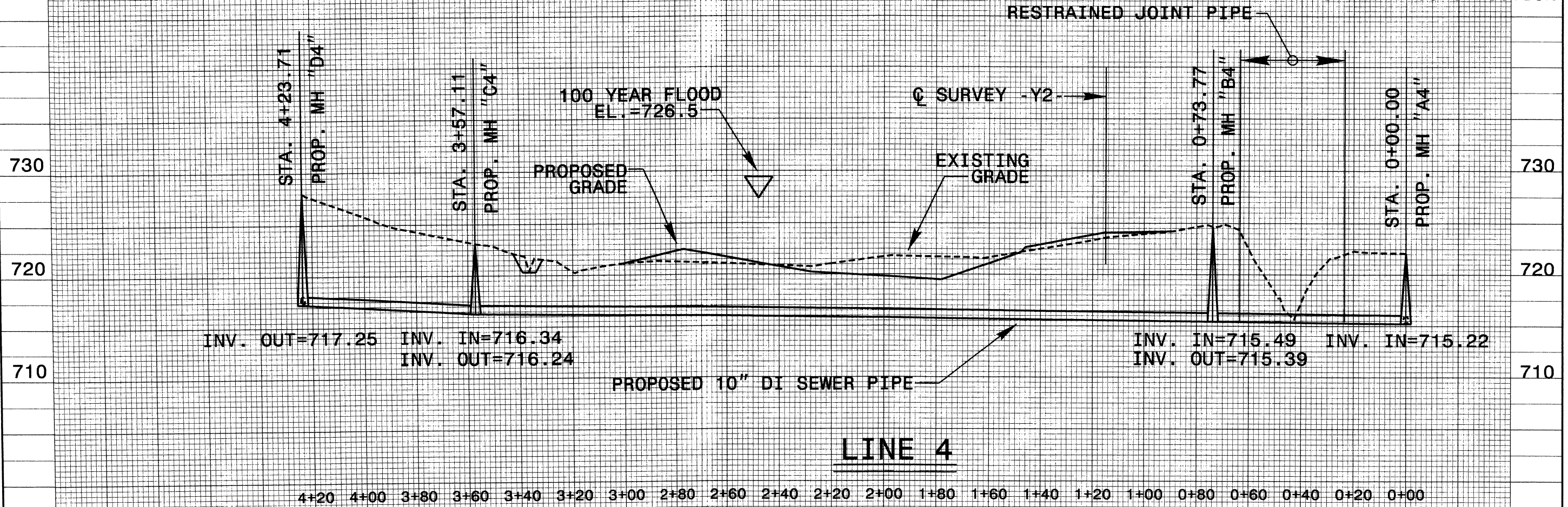
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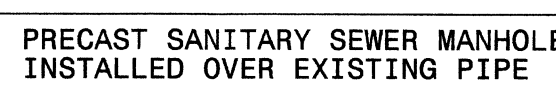
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UC-6

PROJECT REFERENCE NO. B-3157		SHEET NO. UC-6
DESIGNED BY: CSG		
DRAWN BY: CSG		
CHECKED BY: RBW		
APPROVED BY: RBW		
REVISED:		
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION		
DESIGN SERVICES UNIT PHONE: (919) 250-4128 FAX: (919) 250-4119		

WILLIAM B. WILKINS
ENGINEER
10157

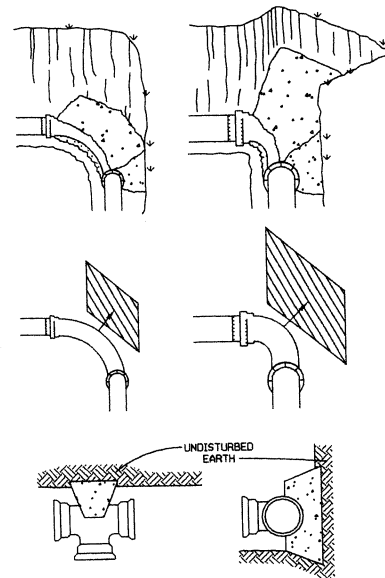
UTILITY CONSTRUCTION





8/17/99

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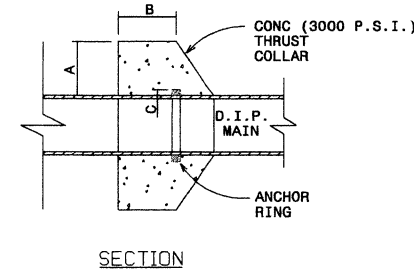
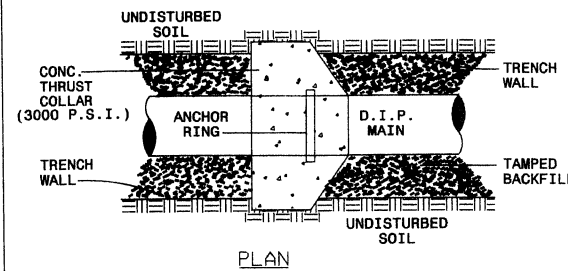


MINIMUM CONCRETE BLOCKING (C.Y.) *					
NOM. PIPE DIA. IN.	TEES & DEAD ENDS	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND
4	1/3	1/3	1/3	1/3	1/3
6	1/3	1/3	1/3	1/3	1/3
8	1/3	1/2	1/3	1/3	1/3
10	2/3	3/4	1/2	1/3	1/3
12	3/4	1.0	2/3	1/3	1/3
14	1.0	1-1/2	3/4	1/2	1/3
16	1-1/3	2.0	1.0	1/2	1/3
18	1-2/3	2-1/3	1-1/3	2/3	1/3
20	2.0	3.0	1-2/3	3/4	1/2
24	3.0	4-1/3	2-1/3	1-1/3	2/3

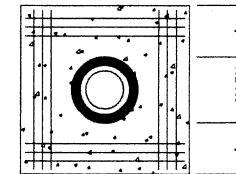
* CONCRETE SHALL BE 3000 P.S.I. MIX.

NOTE:
NO CONCRETE SHALL COVER BOLTS OR GLANDS.

STANDARD REACTION BLOCKING



SCHEDULE				
PIPE DIAMETER	CONCRETE THRUST COLLAR	ANCHOR RING	RINGS REQUIRED	
	A	B	C	
6", 8", 12"	1'-0"	1'-0"	2"	ONE
16"	1'-4"	1'-0"	2"	ONE
20"	1'-4"	1'-0"	3"	ONE
24"	1'-4"	1'-0"	3"	TWO
30"	1'-4"	1'-2"	4"	TWO
36"	1'-4"	1'-4"	4"	TWO



REINFORCING

NOTE:

6" TO 16" MAINS = 12-NO. 7 BARS
20" TO 36" MAINS = 12-NO. 8 BARS
BARS PLACED AS SHOWN

STANDARD THRUST COLLAR INSTALLATION

PROJECT REFERENCE NO. **B-3157** SHEET NO. **UC-8**

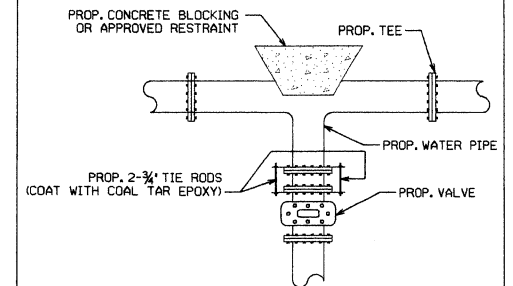
DESIGNED BY: **CSG**
DRAWN BY: **CSG**
CHECKED BY: **RBW**
APPROVED BY: **RBW**
REVISED:

NORTH CAROLINA
DEPARTMENT OF
TRANSPORTATION
DESIGN SERVICES UNIT
PHONE: (919) 250-4128
FAX: (919) 250-4119

ENGINEER
10157
W. B. WILSON
UTILITY CONSTRUCTION
PLANS ONLY

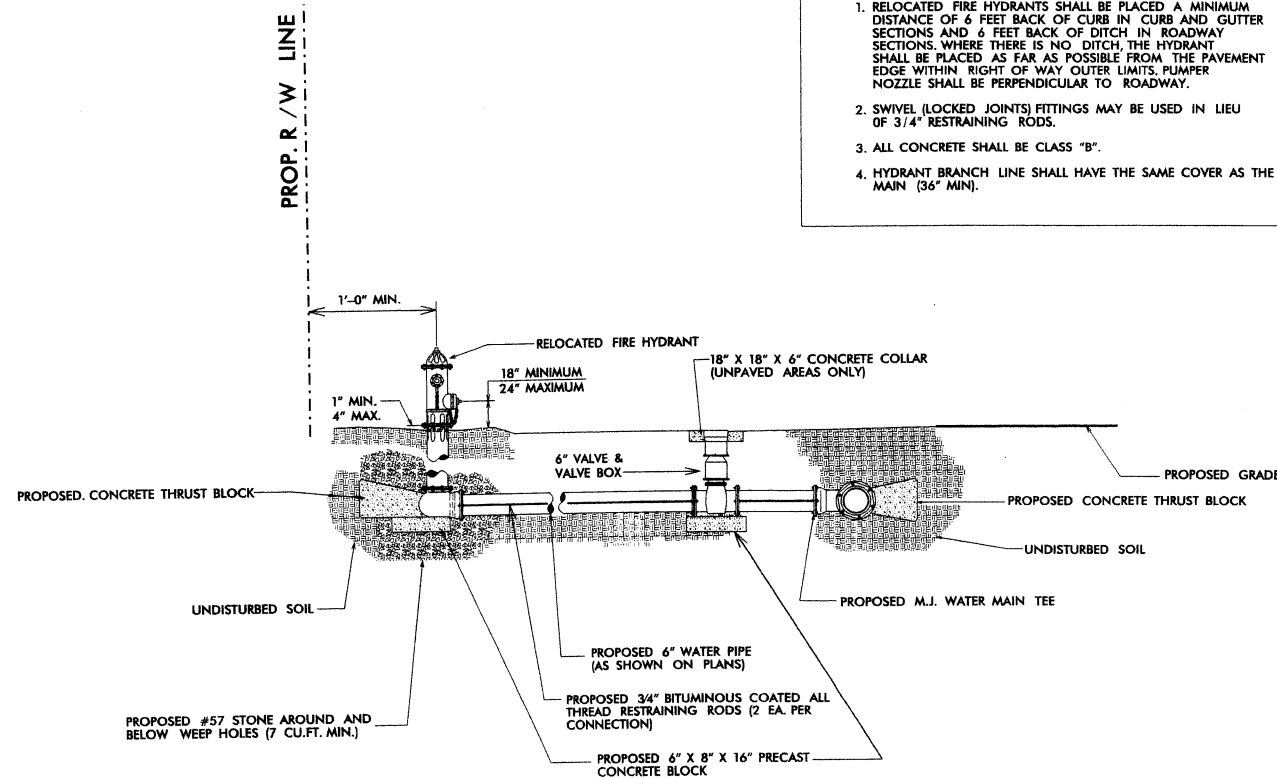
UTILITY CONSTRUCTION

VALVE RESTRAINING DETAIL

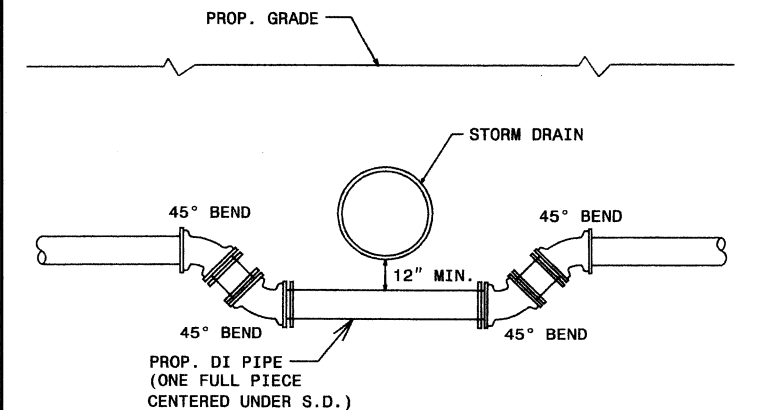


GENERAL NOTES:

- RELOCATED FIRE HYDRANTS SHALL BE PLACED A MINIMUM DISTANCE OF 6 FEET BACK OF CURB IN CURB AND GUTTER SECTIONS AND 6 FEET BACK OF DITCH IN ROADWAY SECTIONS. WHERE THERE IS NO DITCH THE HYDRANT SHALL BE PLACED AS FAR AS POSSIBLE FROM THE PAVEMENT EDGE WITHIN RIGHT OF WAY OUTER LIMITS. PUMPER NOZZLE SHALL BE PERPENDICULAR TO ROADWAY.
- SWIVEL (LOCKED JOINTS) FITTINGS MAY BE USED IN LIEU OF 3/4" RESTRAINING RODS.
- ALL CONCRETE SHALL BE CLASS "B".
- HYDRANT BRANCH LINE SHALL HAVE THE SAME COVER AS THE MAIN (36" MIN).

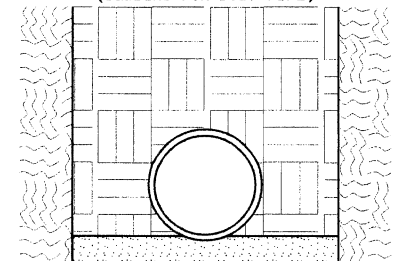


RELOCATED FIRE HYDRANT INSTALLATION DETAIL



PROP. WATER LINE RELOCATION AT STORM DRAINAGE

TYPE "3"
(BEDDING FOR D.I. PIPE)

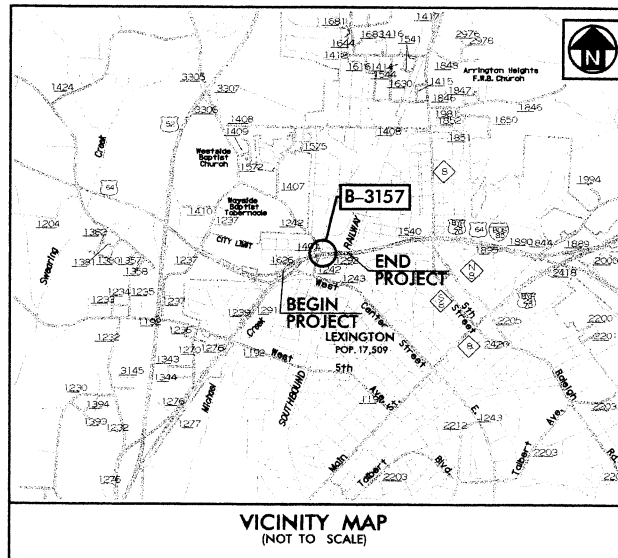


PIPE BEDDED IN 4" MINIMUM LOOSE SOIL. TRENCH BACKFILLED IN LOOSE 6" LAYERS COMPACTED TO TOP OF TRENCH USING LOCAL EXCAVATED MATERIAL. IF APPROVED BY THE ENGINEER, OR SELECT MATERIAL. ALL MATERIAL SHALL BE FREE OF ROCKS, FOREIGN MATERIAL, AND FROZEN EARTH. COMPACTION SHALL BE TO APPROX. 95% DENSITY IN ACCORDANCE WITH AASHTO T-99 AS MODIFIED BY THE DEPARTMENT OF TRANSPORTATION.

TIP: B-3157

CONTRACT : C200781

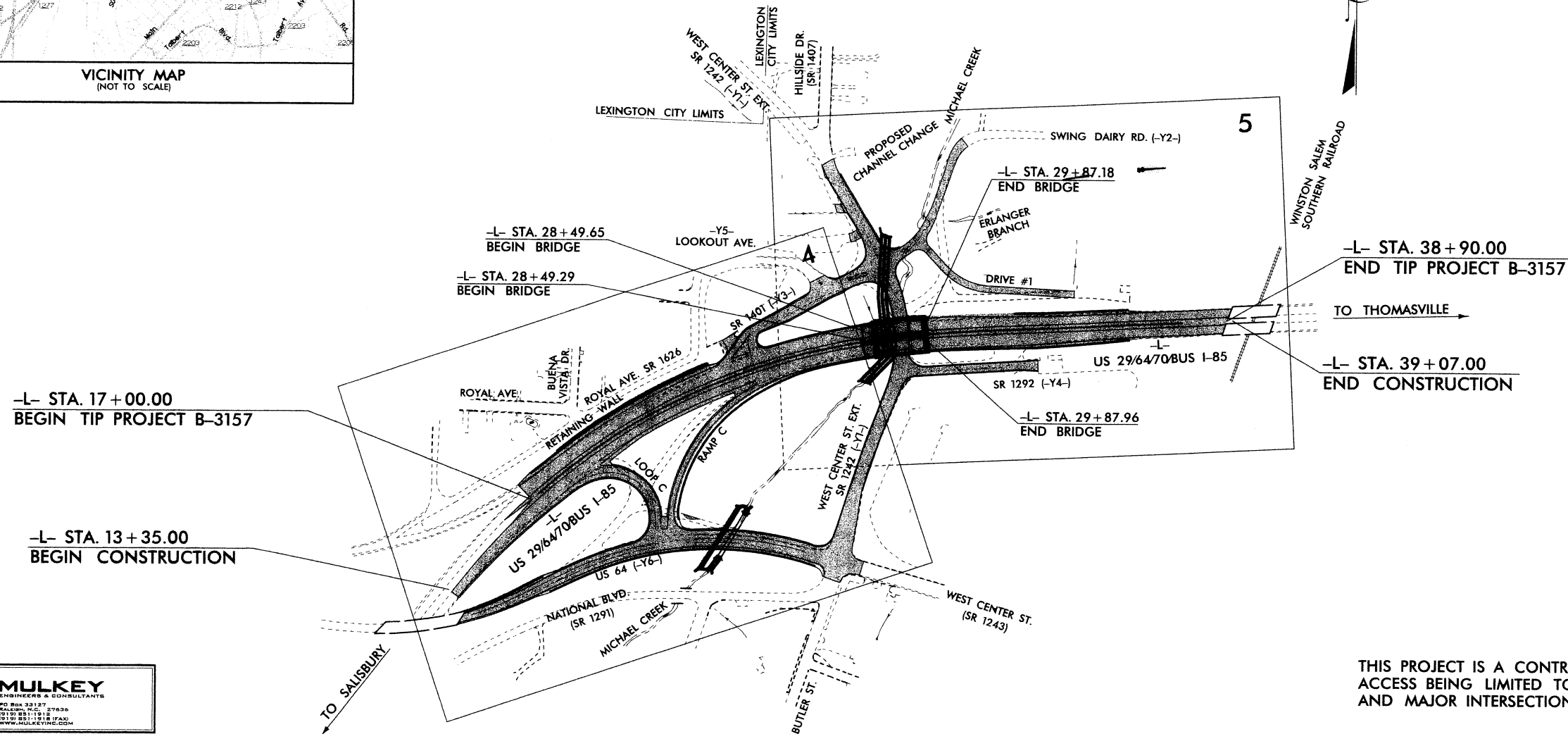
See Sheet 1-A For Index of Sheets
See Sheet 1-B For Conventional Symbols



STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS
DAVIDSON COUNTY

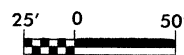
LOCATION: BRIDGE NOS. 74 AND 76 OVER SR 1242 AND MICHAEL CREEK
AND APPROACHES ON US 29/6470 & I-85 BUSINESS
TYPE OF WORK: GRADING, STRUCTURE, DRAINAGE, PAVING, AND SIGNALS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-3157	1	
WBS NO.	F.A. PROJ. NO.	DESCRIPTION	
32899.1.1	BRSTP-29(10)	P.E.	
32899.2.2	BRSTP-29(10)	R/W, UTIL	
32899.3.2	BRSTP-29(10)	CONST	

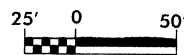


THIS PROJECT IS A CONTROLLED ACCESS PROJECT WITH
ACCESS BEING LIMITED TO THE INTERCHANGE
AND MAJOR INTERSECTIONS.

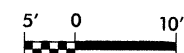
GRAPHIC SCALE



PLANS



PROFILE (HORIZONTAL)



PROFILE (VERTICAL)

DESIGN DATA

ADT 2002 = 26,400

ADT 2023 = 42,160

DHV = 10%

D = 60%

T = 9% *

V = 60 mph

* (Duals = 5% + TTST = 4%)

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-3157 = 0.389 MILE

LENGTH STRUCTURES TIP PROJECT B-3157 = 0.026 MILE

TOTAL LENGTH TIP PROJECT B-3157 = 0.415 MILE

Prepared in the Office of:
Mulkey Engineers & Consultants
FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

2002 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:

MAR. 21, 2003

LETTING DATE:

NOV. 18, 2003

NCDOT CONTACT:

T. S. HAYES, PE
MULKEY E & C
PROJECT DESIGN MANAGER

MULKEY E & C
PROJECT ENGINEER

CATHY S. HOUSER, P.E.
DESIGN SERVICES - PROJECT ENGINEER

HYDRAULICS ENGINEER

DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA

SIGNATURE:

PE

ROADWAY DESIGN

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

SIGNATURE:

PE

STATE HIGHWAY ENGINEER - DESIGN

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED FOR
DIVISION ADMINISTRATOR

DATE

REVISIONS

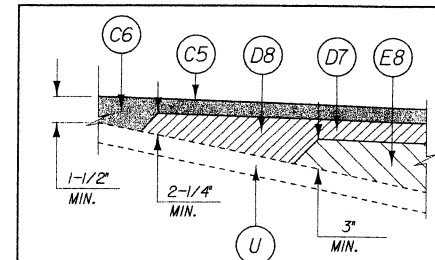
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PAVEMENT SCHEDULE	
C1	PROPOSED APPROXIMATE 1 1/2" ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 168 LBS.PER SQ.YARD.
C2	PROPOSED APPROXIMATE 2 1/2" ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 140 LBS.PER SQ.YARD IN EACH OF 2 LAYERS
C3	PROPOSED VARIABLE DEPTH ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 112 LBS. PER SQ.YARD, PER " DEPTH, TO BE PLACED IN LAYERS NOT LESS THAN 1/4" OR GREATER THAN 1 1/2" IN DEPTH
C4	PROPOSED APPROXIMATE 1 1/2" ASPHALT CONCRETE SURFACE COURSE, TYPE SI2.5C, AT AN AVERAGE RATE OF 168 LBS.PER SQ.YARD.
C5	PROPOSED APPROXIMATE 3" ASPHALT CONCRETE SURFACE COURSE, TYPE SI2.5C, AT AN AVERAGE RATE OF 168 LBS.PER SQ.YARD IN EACH OF 2 LAYERS
C6	PROPOSED VARIABLE DEPTH ASPHALT CONCRETE SURFACE COURSE, TYPE SI2.5C, AT AN AVERAGE RATE OF 112 LBS. PER SQ.YARD, PER " DEPTH, TO BE PLACED IN LAYERS NOT LESS THAN 1/4" OR GREATER THAN 2 1/4" IN DEPTH
D1	PROPOSED APPROXIMATE 2 1/2" ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0B, AT AN AVERAGE RATE OF 285 LBS.PER SQ.YARD
D2	PROPOSED APPROXIMATE 3" ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0B, AT AN AVERAGE RATE OF 342 LBS.PER SQ.YARD
D3	PROPOSED APPROXIMATE 3 1/2" ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0B, AT AN AVERAGE RATE OF 399 LBS.PER SQ.YARD
D4	PROPOSED APPROXIMATE 4" ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0B, AT AN AVERAGE RATE OF 228 LBS.PER SQ.YARD IN EACH OF 2 LAYERS
D5	PROPOSED APPROXIMATE 4 1/2" ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0B, AT AN AVERAGE RATE OF 256.5 LBS.PER SQ.YARD IN EACH OF 2 LAYERS
D6	PROPOSED VARIABLE DEPTH ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0B, AT AN AVERAGE RATE OF 114 LBS. PER SQ.YARD PER " DEPTH, TO BE PLACED IN LAYERS NOT LESS THAN 2 1/4" OR GREATER THAN 4" IN DEPTH
D7	PROPOSED APPROXIMATE 4" ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0C, AT AN AVERAGE RATE OF 456 LBS.PER SQ.YARD
D8	PROPOSED VARIABLE DEPTH ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0C, AT AN AVERAGE RATE OF 114 LBS. PER SQ.YARD PER " DEPTH, TO BE PLACED IN LAYERS NOT LESS THAN 2 1/4" OR GREATER THAN 4" IN DEPTH
E1	PROPOSED APPROXIMATE 3" ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 342 LBS.PER SQ.YARD
E2	PROPOSED APPROXIMATE 3 1/2" ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 399 LBS.PER SQ.YARD
E3	PROPOSED APPROXIMATE 4" ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 456 LBS.PER SQ.YARD
E4	PROPOSED APPROXIMATE 5" ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 570 LBS.PER SQ.YARD
E5	PROPOSED APPROXIMATE 5 1/2" ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 627 LBS.PER SQ.YARD
E6	PROPOSED VARIABLE DEPTH ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 114 LBS. PER SQ.YARD PER " DEPTH, TO BE PLACED IN LAYERS NOT LESS THAN 3" IN DEPTH OR GREATER THAN 5 1/2" IN DEPTH.
E7	PROPOSED APPROXIMATE 9" ASPHALT CONCRETE BASE COURSE, TYPE B25.0C, AT AN AVERAGE RATE OF 513 LBS.PER SQ.YARD IN EACH OF 2 LAYERS
E8	PROPOSED VARIABLE DEPTH ASPHALT CONCRETE BASE COURSE, TYPE B25.0C, AT AN AVERAGE RATE OF 114 LBS. PER SQ.YARD PER " DEPTH, TO BE PLACED IN LAYERS NOT LESS THAN 3" IN DEPTH OR GREATER THAN 5 1/2" IN DEPTH.
J1	6" AGGREGATE BASE COURSE
J2	10" AGGREGATE BASE COURSE
J3	VARIABLE DEPTH AGGREGATE BASE COURSE
R1	2'- 6" CONCRETE CURB AND GUTTER
R2	5' MONOLITHIC CONCRETE ISLAND
R3	CONCRETE EXPRESSWAY GUTTER
R4	MODIFIED CONCRETE EXPRESSWAY GUTTER
R5	SINGLE FACED CONCRETE BARRIER
R6	DOUBLE FACED CONCRETE BARRIER
T	EARTH MATERIAL
U	EXISTING PAVEMENT
W1	WEDGING (SEE WEDGING DETAIL)
W2	WEDGING (SEE WEDGING DETAIL)
W3	WEDGING (SEE WEDGING DETAIL)
W4	WEDGING (SEE WEDGING DETAIL)
W5	WEDGING (SEE WEDGING DETAIL)
W6	WEDGING (SEE WEDGING DETAIL)
W7	WEDGING (SEE WEDGING DETAIL)

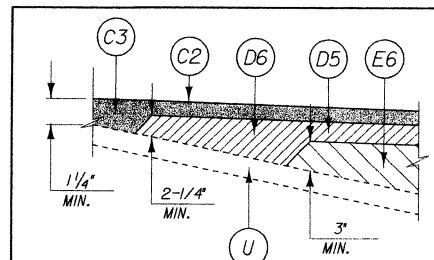
NOTE: ALL PAVEMENT EDGE SLOPES ARE 1:1 UNLESS OTHERWISE SHOWN.

MULKEY
ENGINEERS & CONSULTANTS
PO BOX 32127
KANSAS CITY, MO 64136
(816) 851-1912
(816) 851-1912 FAX
WWW.MULKEYINC.COM

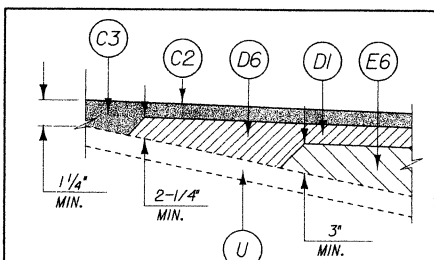
PROJECT REFERENCE NO.	SHEET NO.
B-3157	2
PAVEMENT DESIGN ENGINEER	ROADWAY DESIGN ENGINEER
INCOMPLETE PLANS DO NOT USE FOR CONSTRUCTION	



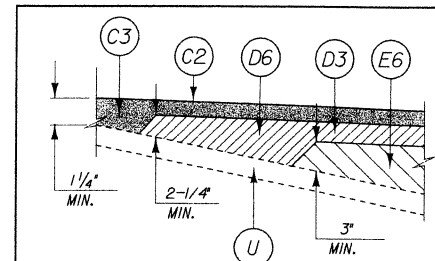
WEDGING DETAIL (W1)



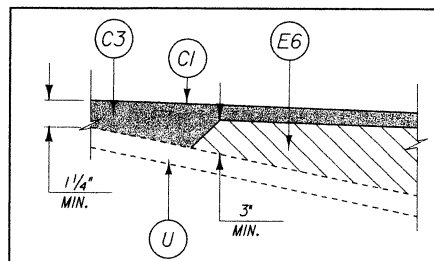
WEDGING DETAIL (W2)



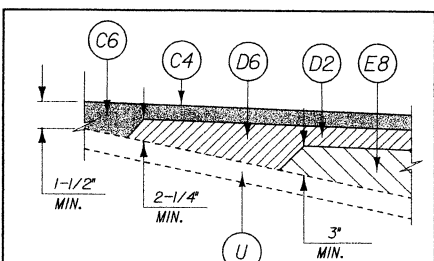
WEDGING DETAIL (W3)



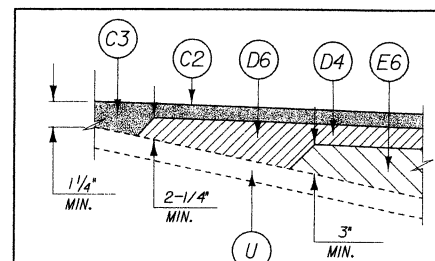
WEDGING DETAIL (W4)



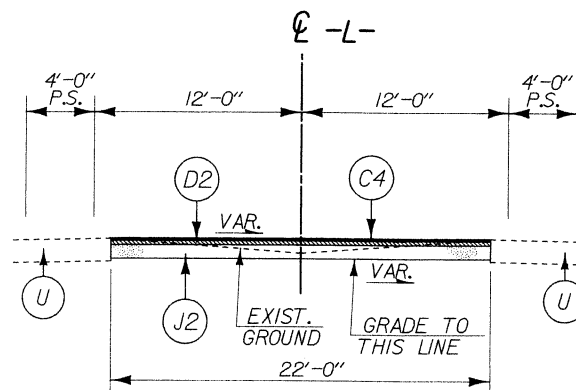
WEDGING DETAIL (W5)



WEDGING DETAIL (W6)



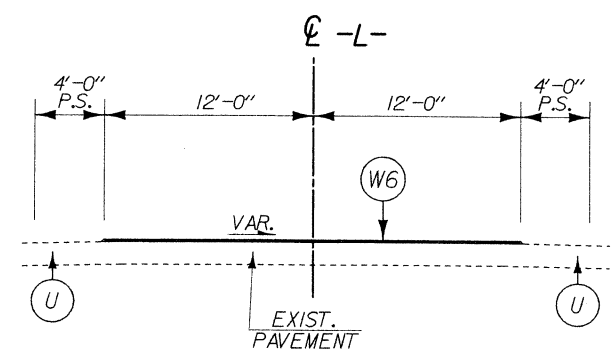
WEDGING DETAIL (W7)



X-OVER PAVEMENT DETAIL #1

USE X-OVER PAVEMENT DETAIL #1 AS FOLLOWS:

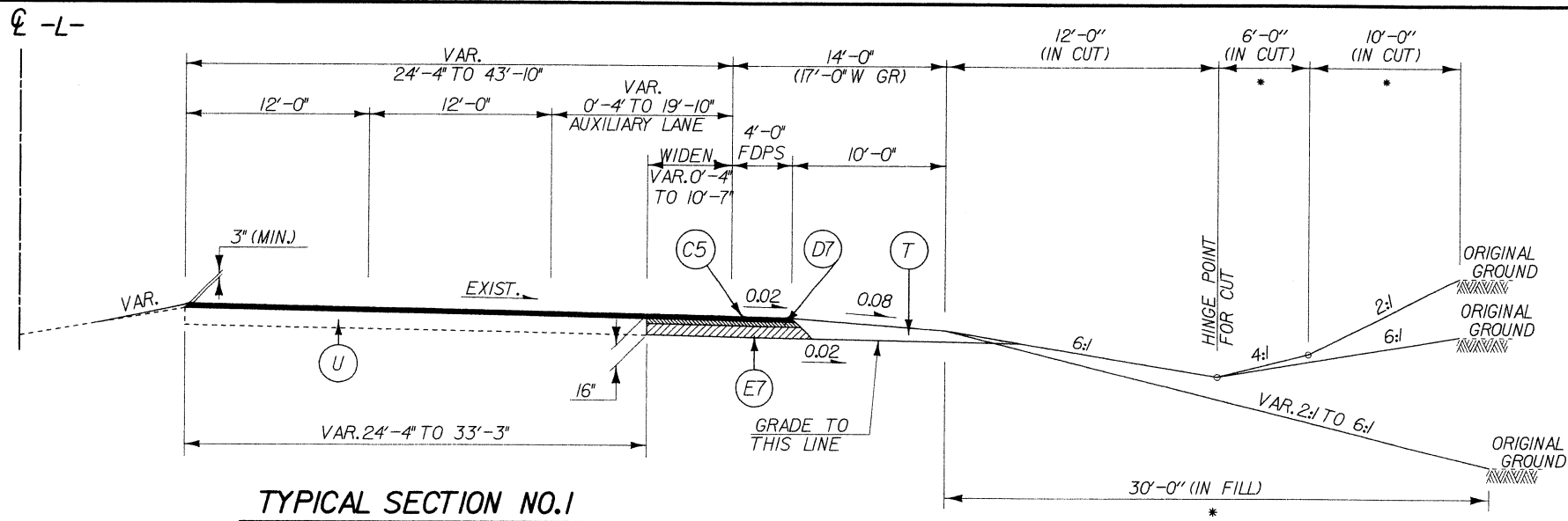
SBL X-OVER #1 STA.11+79.87 TO SBL X-OVER #1 STA.16+9.38
SBL X-OVER #2 STA.10+80.00 TO SBL X-OVER #2 STA.13+91.33



X-OVER PAVEMENT DETAIL #2

USE X-OVER PAVEMENT DETAIL #2 AS FOLLOWS:

NBL X-OVER #1 STA.12+47.17 TO NBL X-OVER #1 STA.16+50.00
NBL X-OVER #2 STA.10+50.00 TO NBL X-OVER #2 STA.15+25.00

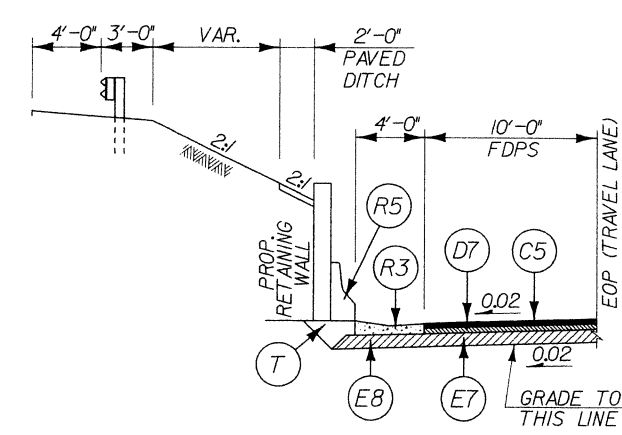
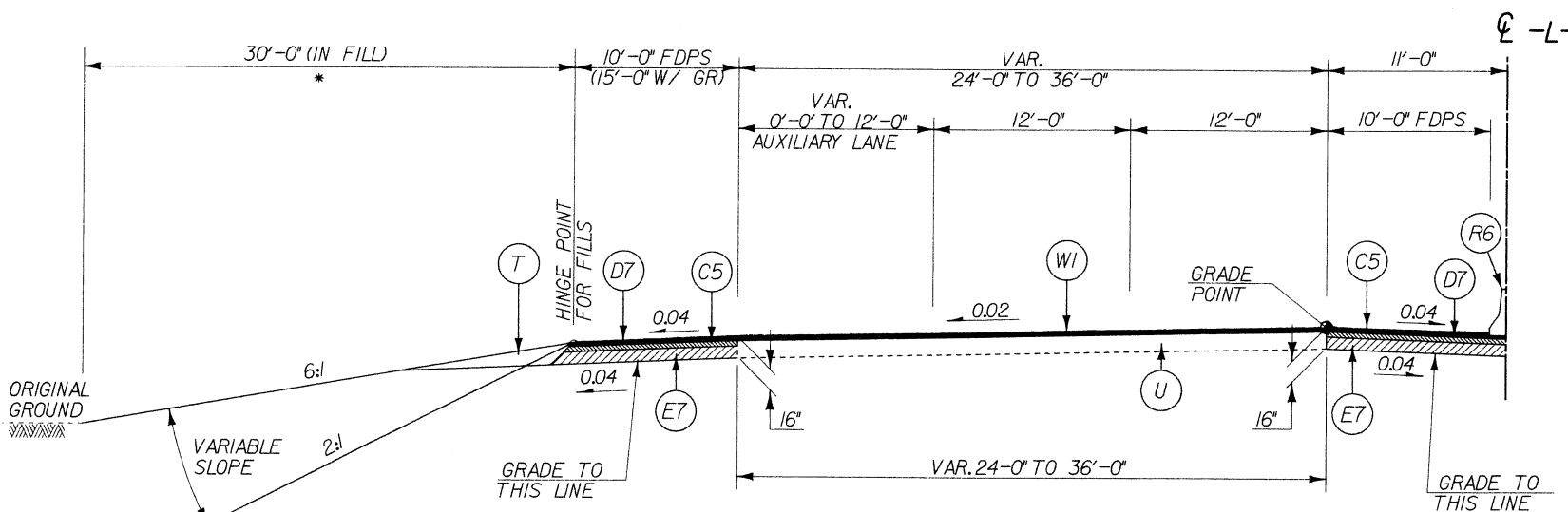


TYPICAL SECTION NO.1

USE TYPICAL SECTION No.1 AS FOLLOWS:

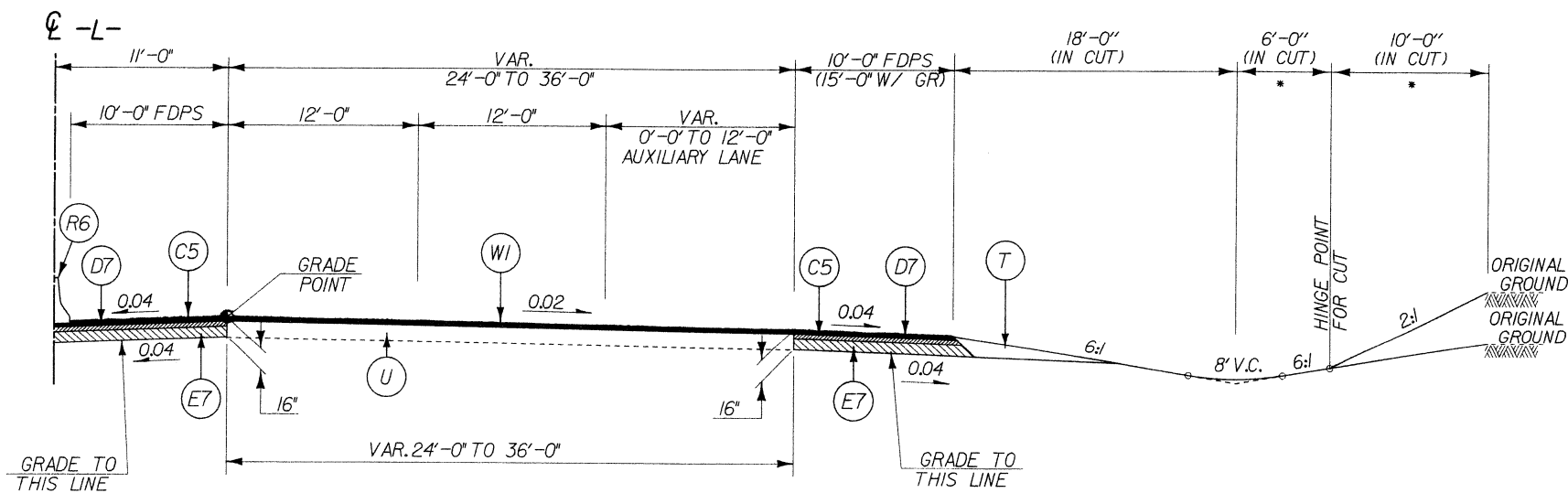
TRANSITION FROM EXISTING TO T.S.No.1 FROM -L- STA.13+35 TO -L- STA.14+00
FROM -L- STA.14+00.00 TO -L- STA.17+00

* WHEN THESE DISTANCES INDICATE SLOPES OUTSIDE THE LIMITS OF 6:1 TO 2:1, THE DISTANCE BECOMES VARIABLE AND THE MAXIMUM OR MINIMUM SLOPE MAINTAINED.



INSET NO.1

TO BE USED IN CONJUNCTION WITH TYPICAL SECTION No.2 AS FOLLOWS:
FROM -L- STA.17+50.00 TO -L- STA.18+25.00 (NO WALL, BARRIER, OR 4' PAVED DITCH)
FROM -L- STA.18+25.00 TO -L- STA.18+50.00 (NO BARRIER)
FROM -L- STA.18+50.00 TO -L- STA.23+50.00



TYPICAL SECTION NO.2

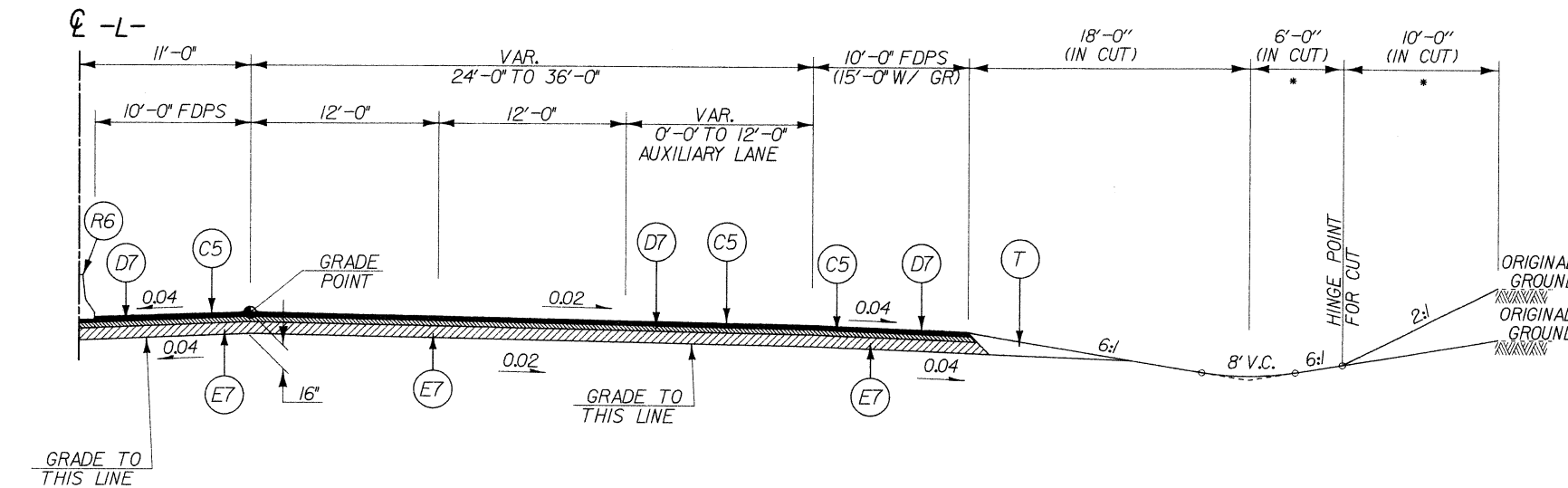
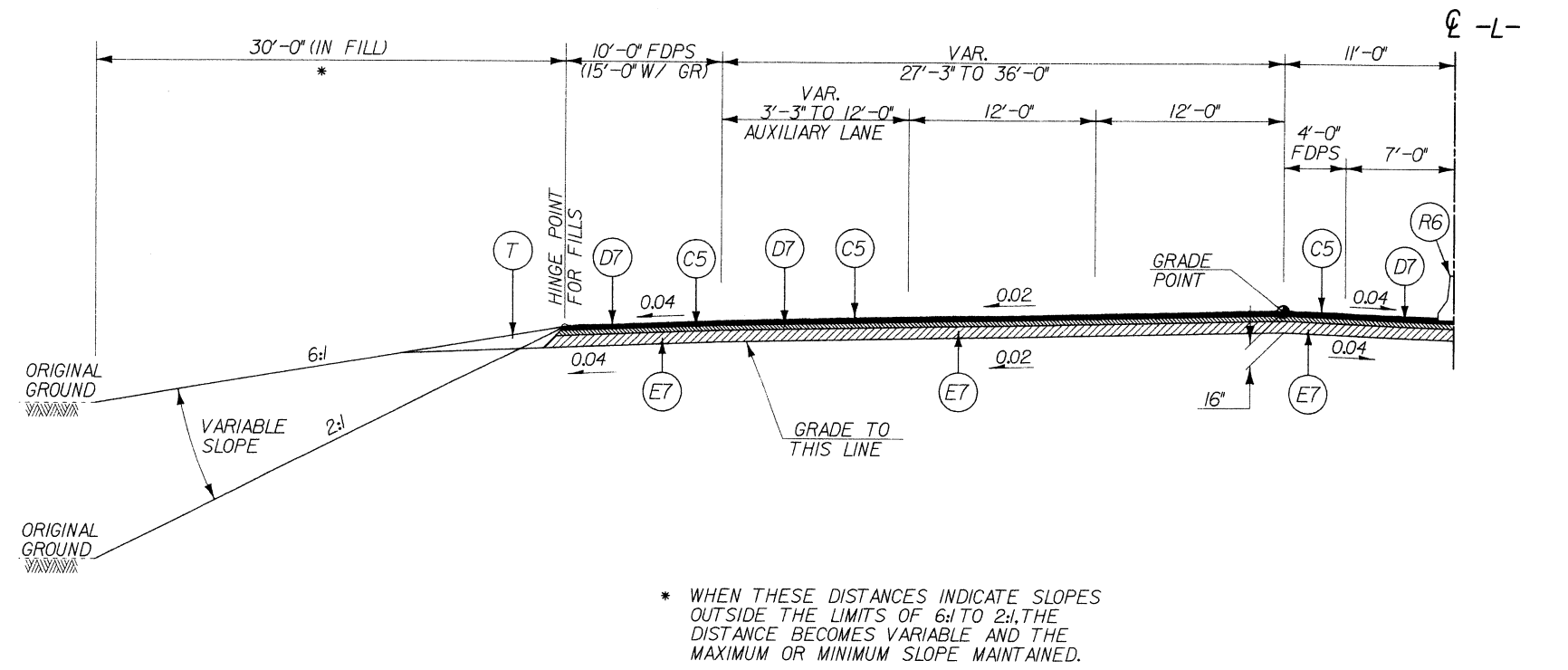
USE TYPICAL SECTION No.2 AS FOLLOWS:

FROM -L- STA.17+00.00 TO -L- STA.23+00
FROM -L- STA.34+00 TO -L- STA.38+50.00
TRANSITION FROM T.S.No.2 TO EXISTING FROM -L- STA.38+50 TO -L- STA.38+90.00

* WHEN THESE DISTANCES INDICATE SLOPES OUTSIDE THE LIMITS OF 6:1 TO 2:1, THE DISTANCE BECOMES VARIABLE AND THE MAXIMUM OR MINIMUM SLOPE MAINTAINED.

C1	1 1/2" S9.5B
C2	2 1/2" S9.5B
C3	VAR. DEPTH S9.5B
C4	1 1/2" S12.5C
C5	3" S12.5C
C6	VAR. DEPTH S12.5C
D1	2 1/2" I19.0B
D2	3" I19.0B
D3	3 1/2" I19.0B
D4	4" I19.0B
D5	4 1/2" I19.0B
D6	VAR. DEPTH I19.0B
D7	4" I19.0C
D8	VAR. DEPTH I19.0C
E1	3" B25.0B
E2	3 1/2" B25.0B
E3	4" B25.0B
E4	5" B25.0B
E5	5 1/2" B25.0B
E6	VAR. DEPTH B25.0B
E7	9" B25.0C
E8	VAR. DEPTH B25.0C
J1	6" ABC
J2	10" ABC
J3	VAR. DEPTH ABC
R1	2'-6" CONC. CURB & GUTTER
R2	5' MONO. CONC. ISLAND
R3	CONC. EXPRESS. GUTTER
R4	MOD. CONCRETE EXPRESS. GUTTER
R5	SINGLE FACED CONC. BARRIER
R6	DOUBLE FACED CONC. BARRIER
T	EARTH MATERIAL
U	EXIST. PAVEMENT
W1	WEDGING
W2	WEDGING
W3	WEDGING
W4	WEDGING
W5	WEDGING
W6	WEDGING
W7	WEDGING

NOTE:
1. SEE SHEET 2 FOR DETAILED DESCRIPTION OF PAVEMENT SCHEDULE.
2. ALL PAVEMENT EDGES ARE 1:1 UNLESS OTHERWISE NOTED.



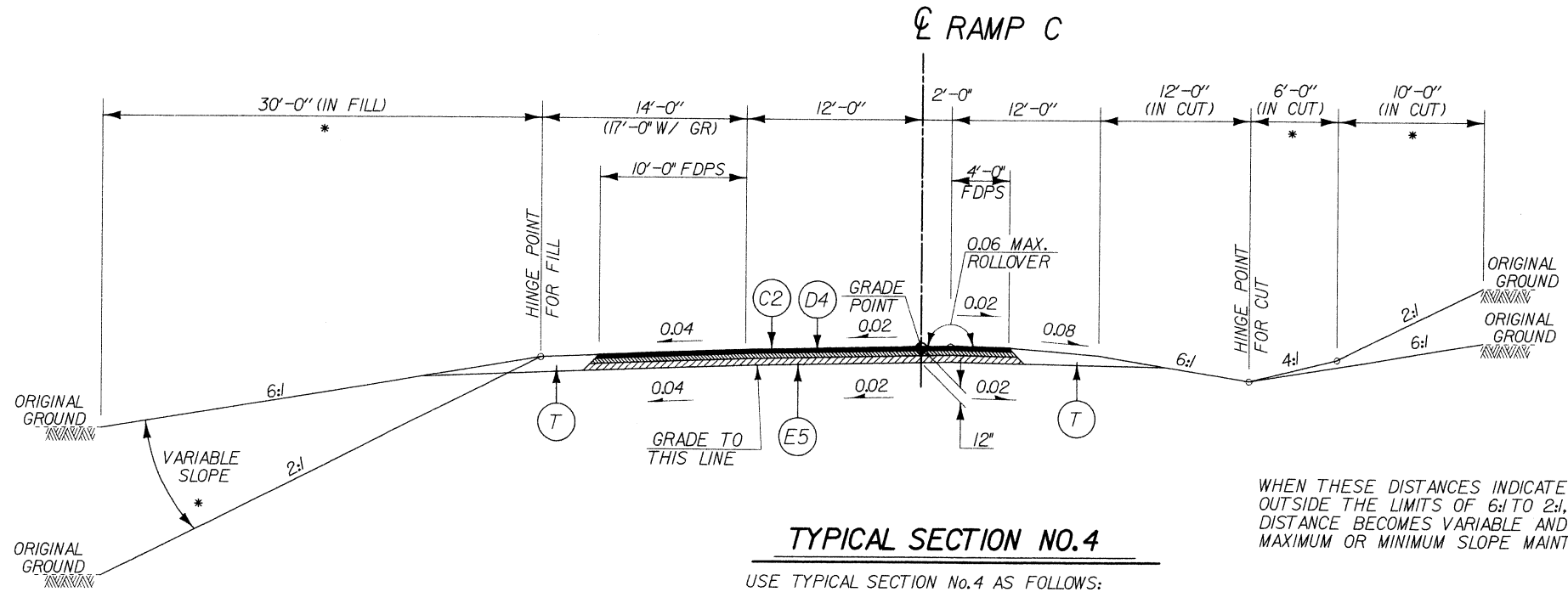
TYPICAL SECTION NO.3

USE TYPICAL SECTION No.3 AS FOLLOWS:
FROM -L- STA.23+00 TO -L- STA.28+49.29 (BEGIN BRIDGE)
FROM -L- STA.29+87.96 (END BRIDGE) TO -L- STA.34+00

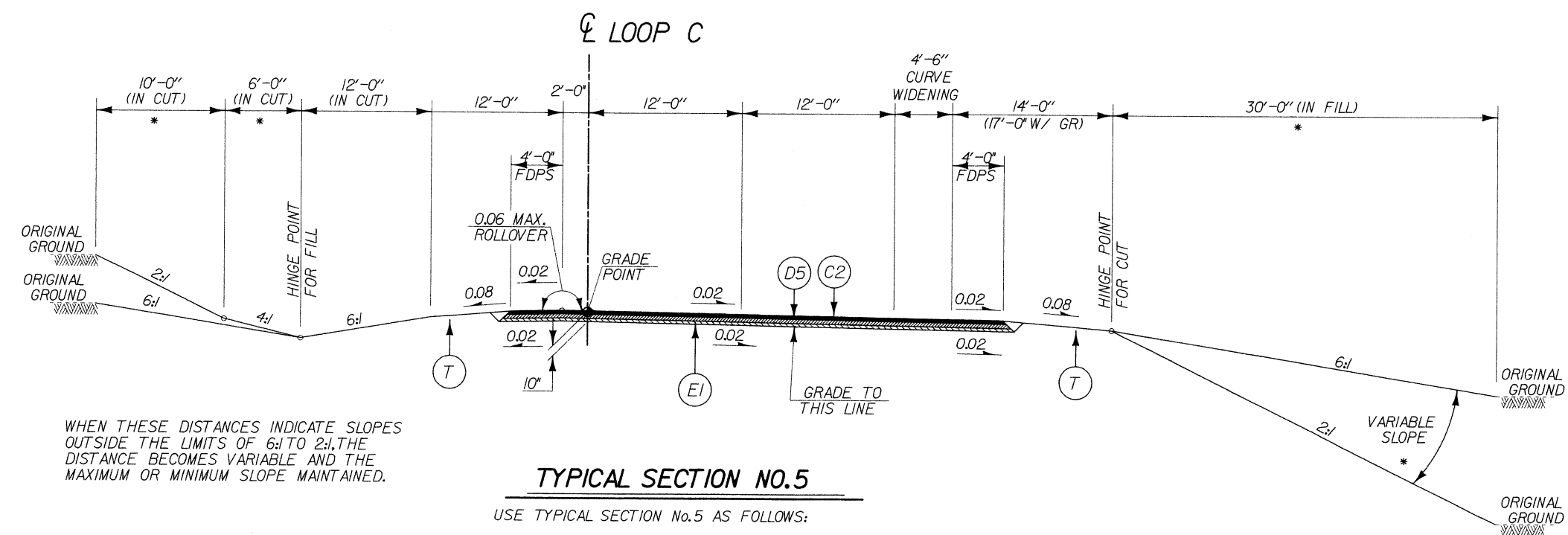
C1	1 1/2" S9.5B
C2	2 1/2" S9.5B
C3	VAR.DEPTH S9.5B
C4	1 1/2" S12.5C
C5	3" S12.5C
C6	VAR.DEPTH S12.5C
D1	2 1/2" 119.0B
D2	3" 119.0B
D3	3 1/2" 119.0B
D4	4" 119.0B
D5	4 1/2" 119.0B
D6	VAR.DEPTH 119.0B
D7	4" 119.0C
D8	VAR.DEPTH 119.0C
E1	3" B25.0B
E2	3 1/2" B25.0B
E3	4" B25.0B
E4	5" B25.0B
E5	5 1/2" B25.0B
E6	VAR.DEPTH B25.0B
E7	9" B25.0C
E8	VAR.DEPTH B25.0C
J1	6" ABC
J2	10" ABC
J3	VAR.DEPTH ABC
R1	2'-6" CONC. CURB & GUTTER
R2	5" MONO. CONC.ISLAND
R3	CONC. EXPRESS.GUTTER
R4	MOD.CONCRETE EXPRESS.GUTTER
R5	SINGLE FACED CONC.BARRIER
R6	DOUBLE FACED CONC.BARRIER
T	EARTH MATERIAL
U	EXIST.PAVEMENT
W1	WEDGING
W2	WEDGING
W3	WEDGING
W4	WEDGING
W5	WEDGING
W6	WEDGING
W7	WEDGING

NOTE:
1. SEE SHEET 2 FOR DETAILED DESCRIPTION OF PAVEMENT SCHEDULE.
2. ALL PAVEMENT EDGES ARE 1:1 UNLESS OTHERWISE NOTED.

REVISIONS



TYPICAL SECTION NO.4
USE TYPICAL SECTION No.4 AS FOLLOWS:
FROM RAMP C STA.2+75.92 TO RAMP C STA.6+63.22

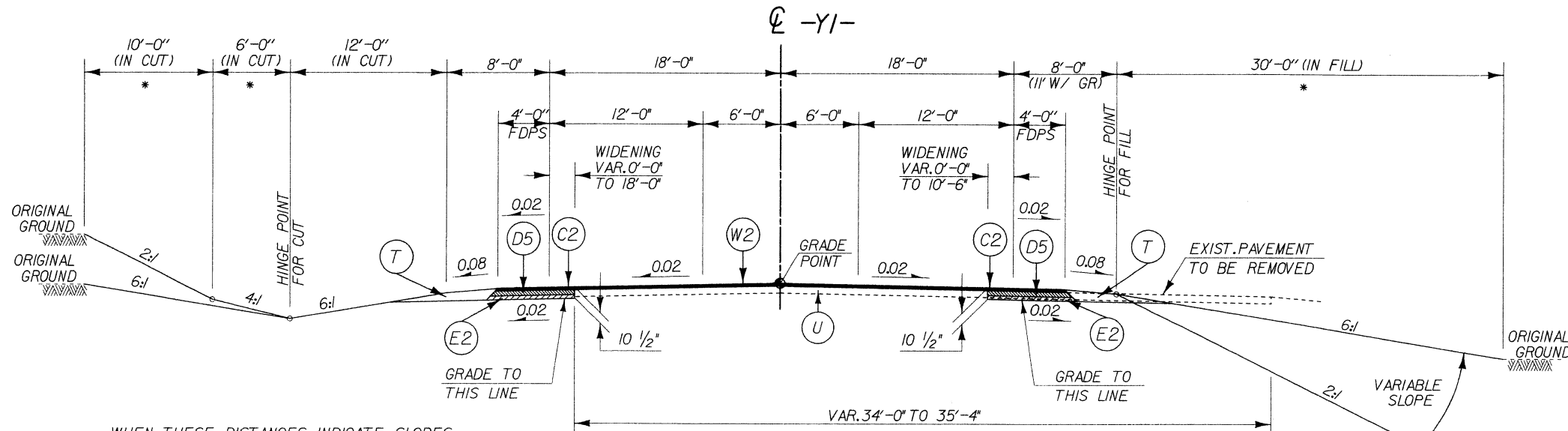


TYPICAL SECTION NO.5
USE TYPICAL SECTION No.5 AS FOLLOWS:
FROM LOOP C STA.1+79.86 TO LOOP C STA.4+00.99

C1	1 1/2" S9.5B
C2	2 1/2" S9.5B
C3	VAR.DEPTH S9.5B
C4	1 1/2" S12.5C
C5	3" S12.5C
C6	VAR.DEPTH S12.5C
D1	2 1/2" I19.0B
D2	3" I19.0B
D3	3 1/2" I19.0B
D4	4" I19.0B
D5	4 1/2" I19.0B
D6	VAR.DEPTH I19.0B
D7	4" I19.0C
D8	VAR.DEPTH I19.0C
E1	3" B25.0B
E2	3 1/2" B25.0B
E3	4" B25.0B
E4	5" B25.0B
E5	5 1/2" B25.0B
E6	VAR.DEPTH B25.0B
E7	9" B25.0C
E8	VAR.DEPTH B25.0C
J1	6" ABC
J2	10" ABC
J3	VAR.DEPTH ABC
R1	2'-6" CONC. CURB & GUTTER
R2	5' MONO. CONC.ISLAND
R3	CONC. EXPRESS.GUTTER
R4	MOD.CONCRETE EXPRESS.GUTTER
R5	SINGLE FACED CONC.BARRIER
R6	DOUBLE FACED CONC.BARRIER
T	EARTH MATERIAL
U	EXIST.PAVEMENT
W1	WEDGING
W2	WEDGING
W3	WEDGING
W4	WEDGING
W5	WEDGING
W6	WEDGING
W7	WEDGING

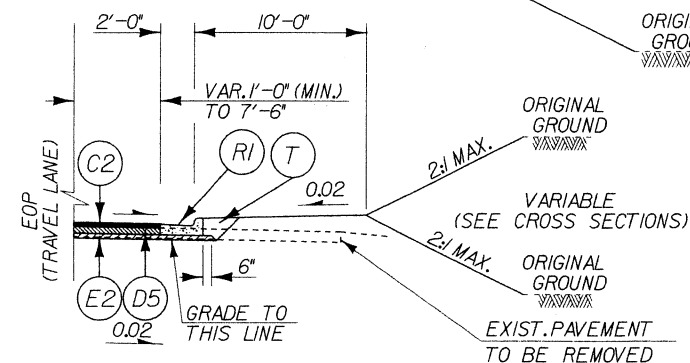
NOTE:
1. SEE SHEET 2 FOR DETAILED DESCRIPTION OF PAVEMENT SCHEDULE.
2. ALL PAVEMENT EDGES ARE 1:1 UNLESS OTHERWISE NOTED.

REVISIONS



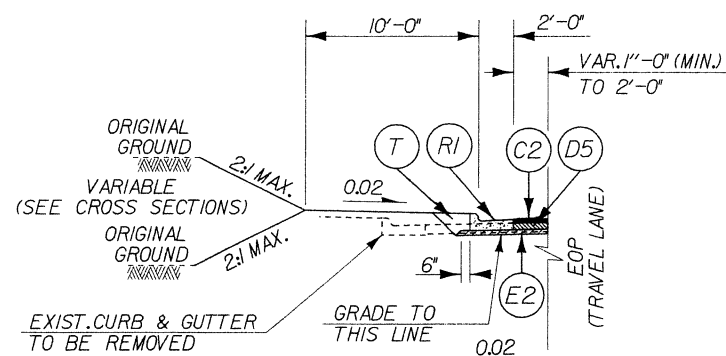
TYPICAL SECTION NO.6

TRANSITION FROM EXISTING TO T.S.No.6 FROM
-YI- STA.14+00.00 TO -YI- STA.14+50.00
USE TYPICAL SECTION No.6 AS FOLLOWS:
FROM -YI- STA.14+50.00 TO -YI- STA.17+40.75



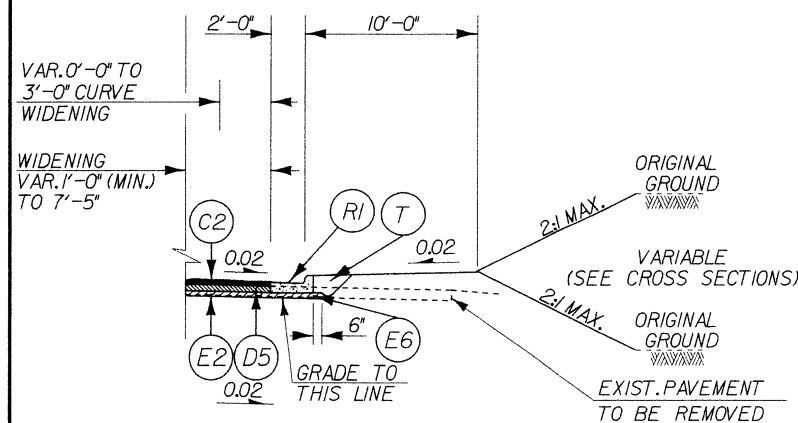
INSET NO.2

TO BE USED IN CONJUNCTION WITH
TYPICAL SECTION No.6 AS FOLLOWS:
FROM -YI- STA.14+36.45 TO -YI- STA.16+80.34 RT.



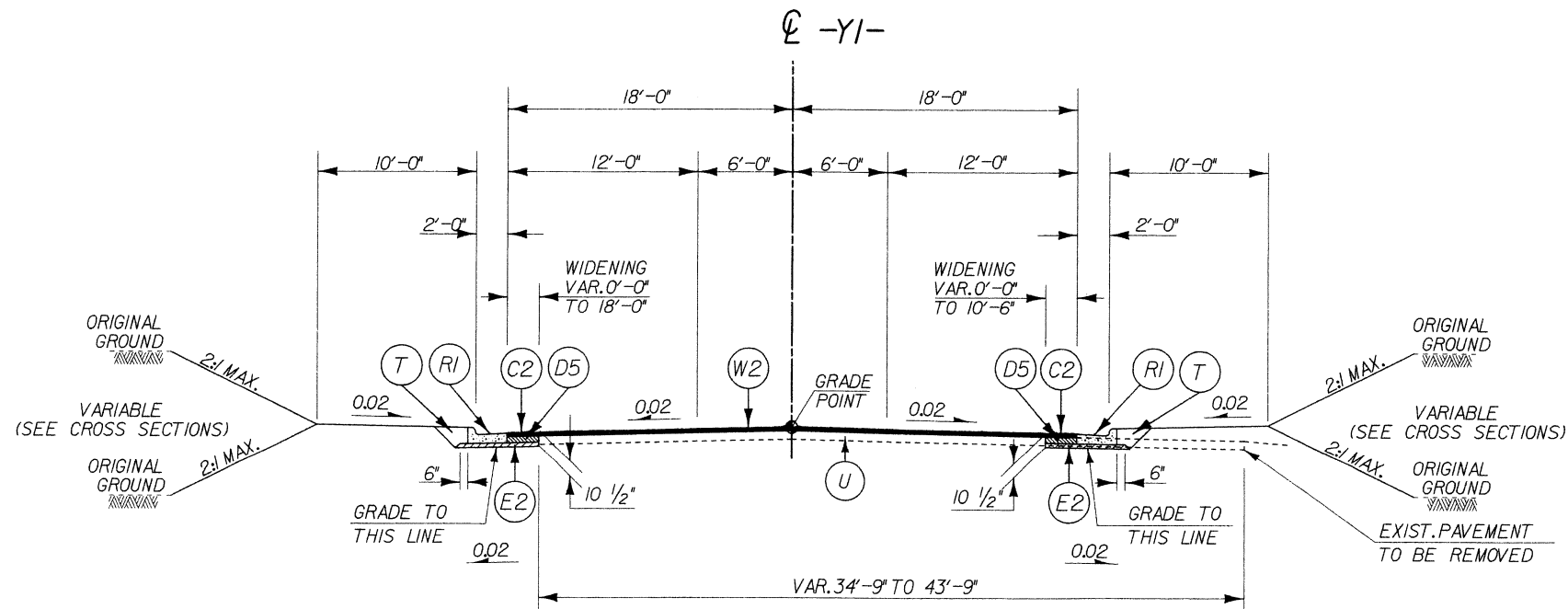
INSET NO.3

TO BE USED IN CONJUNCTION WITH
TYPICAL SECTION No.7 AS FOLLOWS:
FROM -YI- STA.21+13 TO -YI- STA.24+44.21 LT.
FROM -YI- STA.23+96 TO -YI- STA.24+95.94 RT.



INSET NO.4

TO BE USED IN CONJUNCTION WITH
TYPICAL SECTION No.7 AS FOLLOWS:
FROM -YI- STA.18+09.32 TO -YI- STA.22+24.08 RT.



TYPICAL SECTION NO.7

USE TYPICAL SECTION No.7 AS FOLLOWS:

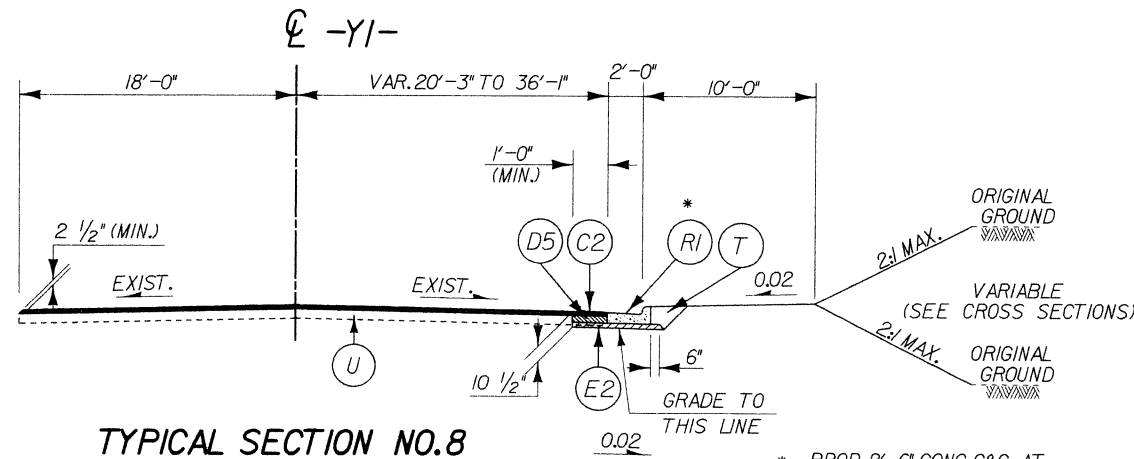
FROM -YI- STA.17+40.75 TO -YI- STA.24+00.00
TRANSITION FROM T.S.No.7 TO T.S.No.8 FROM
-YI- STA.24+00.00 TO -YI- STA.25+00.00

C1	1 1/2" S9.5B
C2	2 1/2" S9.5B
C3	VAR. DEPTH S9.5B
C4	1 1/2" S12.5C
C5	3" S12.5C
C6	VAR. DEPTH S12.5C
D1	2 1/2" I19.0B
D2	3" I19.0B
D3	3 1/2" I19.0B
D4	4" I19.0B
D5	4 1/2" I19.0B
D6	VAR. DEPTH I19.0B
D7	4" I19.0C
D8	VAR. DEPTH I19.0C
E1	3" B25.0B
E2	3 1/2" B25.0B
E3	4" B25.0B
E4	5" B25.0B
E5	5 1/2" B25.0B
E6	VAR. DEPTH B25.0B
E7	9" B25.0C
E8	VAR. DEPTH B25.0C
J1	6" ABC
J2	10" ABC
J3	VAR. DEPTH ABC
R1	2'-6" CONC. CURB & GUTTER
R2	5' MONO. CONC. ISLAND
R3	CONC. EXPRESS. GUTTER
R4	MOD. CONCRETE EXPRESS. GUTTER
R5	SINGLE FACED CONC. BARRIER
R6	DOUBLE FACED CONC. BARRIER
T	EARTH MATERIAL
U	EXIST. PAVEMENT
W1	WEDGING
W2	WEDGING
W3	WEDGING
W4	WEDGING
W5	WEDGING
W6	WEDGING
W7	WEDGING

NOTE:
1. SEE SHEET 2 FOR DETAILED DESCRIPTION OF PAVEMENT SCHEDULE.
2. ALL PAVEMENT EDGES ARE 1:1 UNLESS OTHERWISE NOTED.

REVISIONS

06/30/2003 03:20:52 PM
G:\PROJECTS\2002\124.00_B3157\Roadway\Project\B3157_RDV_TYP.DGN

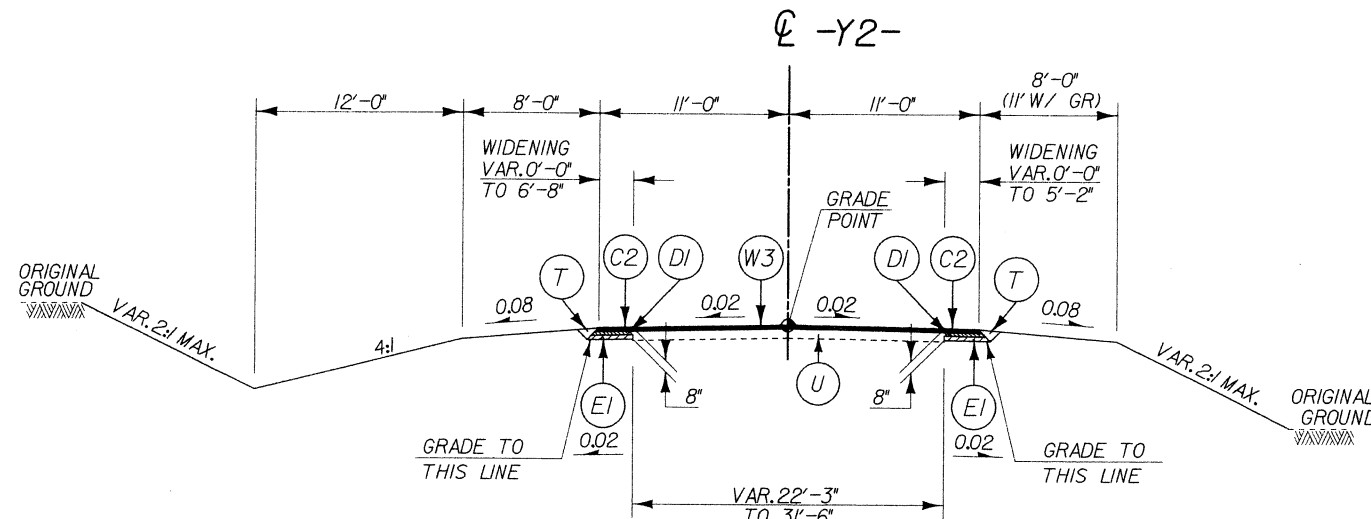


TYPICAL SECTION NO.8

USE TYPICAL SECTION No.8 AS FOLLOWS:

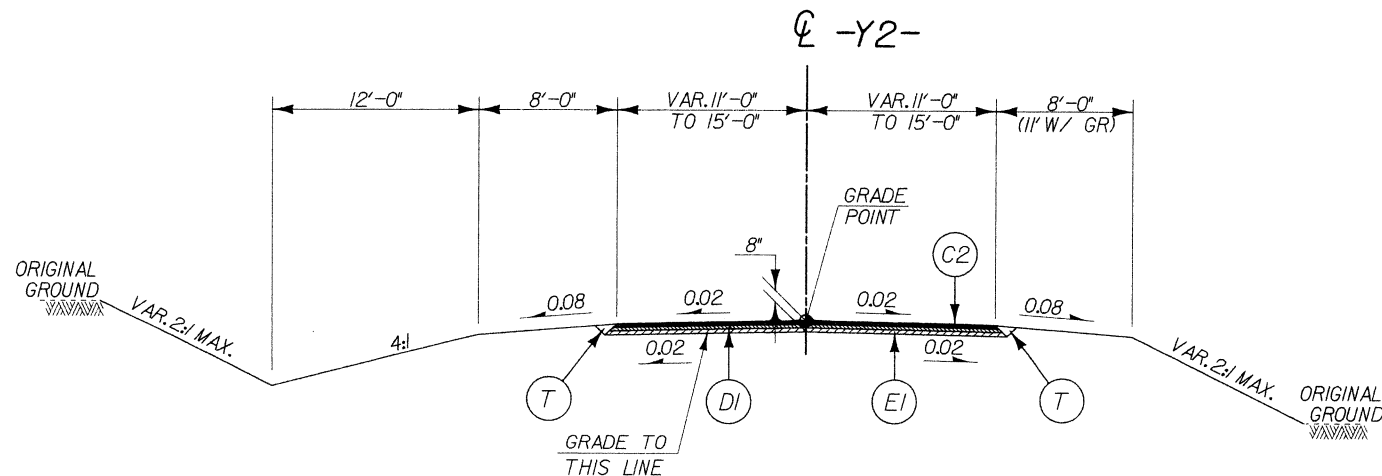
FROM -Y1- STA.24+00.00 TO -Y1- STA.27+30.00

* PROP. 2'-6" CONC. C&G AT LOCATIONS SHOWN IN PLANS.



TYPICAL SECTION NO.9

USE TYPICAL SECTION No.9 AS FOLLOWS:
FROM -Y2- STA.12+06 TO -Y2- STA.13+50.00
TRANSITION FROM T.S.No.9 TO EXISTING FROM
-Y2- STA.13+50.00 TO -Y2- STA.14+50.00



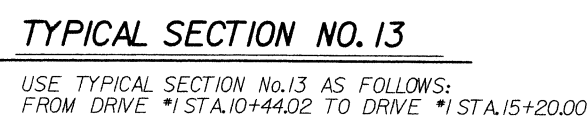
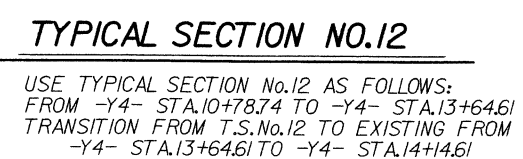
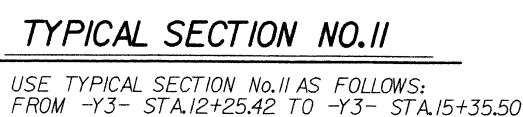
TYPICAL SECTION NO.10

USE TYPICAL SECTION No.10 AS FOLLOWS:
FROM -Y2- STA.10+64.22 TO -Y2- STA.12+06

C1	1 1/2" S9.5B
C2	2 1/2" S9.5B
C3	VAR. DEPTH S9.5B
C4	1 1/2" S12.5C
C5	3" S12.5C
C6	VAR. DEPTH S12.5C
D1	2 1/2" I19.0B
D2	3" I19.0B
D3	3 1/2" I19.0B
D4	4" I19.0B
D5	4 1/2" I19.0B
D6	VAR. DEPTH I19.0B
D7	4" I19.0C
D8	VAR. DEPTH I19.0C
E1	3" B25.0B
E2	3 1/2" B25.0B
E3	4" B25.0B
E4	5" B25.0B
E5	5 1/2" B25.0B
E6	VAR. DEPTH B25.0B
E7	9" B25.0C
E8	VAR. DEPTH B25.0C
J1	6" ABC
J2	10" ABC
J3	VAR. DEPTH ABC
R1	2'-6" CONC. CURB & GUTTER
R2	5' MONO. CONC. ISLAND
R3	CONC. EXPRESS. GUTTER
R4	MOD. CONCRETE EXPRESS. GUTTER
R5	SINGLE FACED CONC. BARRIER
R6	DOUBLE FACED CONC. BARRIER
T	EARTH MATERIAL
U	EXIST. PAVEMENT
W1	WEDGING
W2	WEDGING
W3	WEDGING
W4	WEDGING
W5	WEDGING
W6	WEDGING
W7	WEDGING

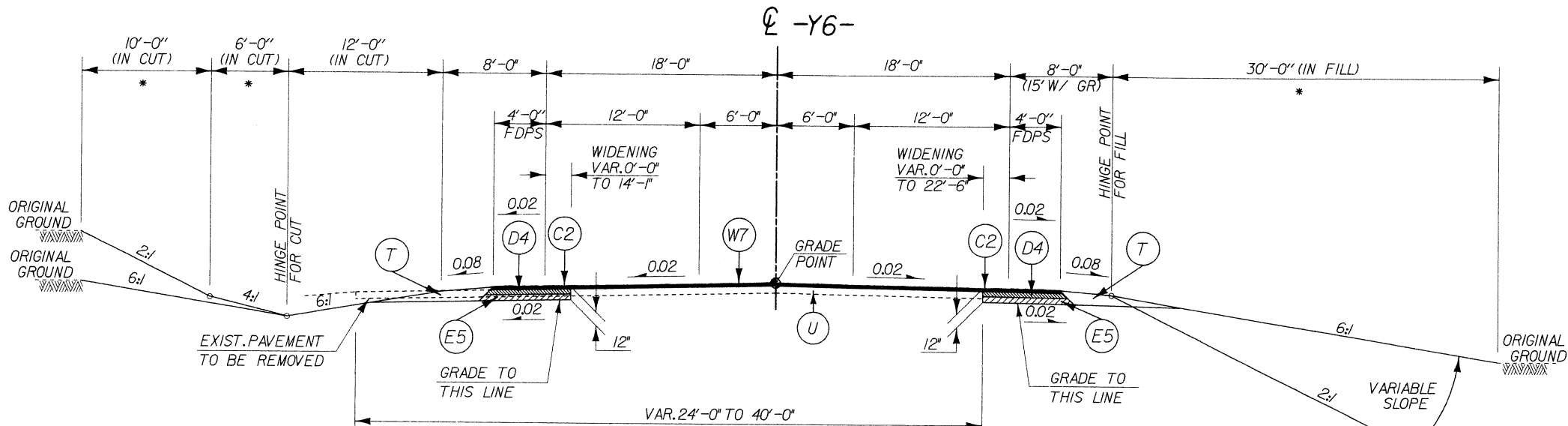
NOTE:
1. SEE SHEET 2 FOR DETAILED DESCRIPTION OF PAVEMENT SCHEDULE.
2. ALL PAVEMENT EDGES ARE 1:1 UNLESS OTHERWISE NOTED.

REVISIONS



C1	1 1/2" S9.5B
C2	2 1/2" S9.5B
C3	VAR.DEPTH S9.5B
C4	1 1/2" S12.5C
C5	3" S12.5C
C6	VAR.DEPTH S12.5C
D1	2 1/2" I19.0B
D2	3" I19.0B
D3	3 1/2" I19.0B
D4	4" I19.0B
D5	4 1/2" I19.0B
D6	VAR. DEPTH I19.0B
D7	4" I19.0C
D8	VAR. DEPTH I19.0C
E1	3" B25.0B
E2	3 1/2" B25.0B
E3	4" B25.0B
E4	5" B25.0B
E5	5 1/2" B25.0B
E6	VAR. DEPTH B25.0B
E7	9" B25.0C
E8	VAR. DEPTH B25.0C
J1	6" ABC
J2	10" ABC
J3	VAR. DEPTH ABC
R1	2'-6" CONC. CURB & GUTTER
R2	5' MONO. CONC. ISLAND
R3	CONC. EXPRESS. GUTTER
R4	MOD. CONCRETE EXPRESS. GUTTER
R5	SINGLE FACED CONC. BARRIER
R6	DOUBLE FACED CONC. BARRIER
T	EARTH MATERIAL
U	EXIST. PAVEMENT
W1	WEDGING
W2	WEDGING
W3	WEDGING
W4	WEDGING
W5	WEDGING
W6	WEDGING
W7	WEDGING

NOTE:
1. SEE SHEET 2 FOR
DETAILED DESCRIPTION
OF PAVEMENT SCHEDULE.
2. ALL PAVEMENT EDGES
ARE 1:1 UNLESS OTHERWISE
NOTED.



* WHEN THESE DISTANCES INDICATE SLOPES OUTSIDE THE LIMITS OF 6:1 TO 2:1, THE DISTANCE BECOMES VARIABLE AND THE MAXIMUM OR MINIMUM SLOPE MAINTAINED.

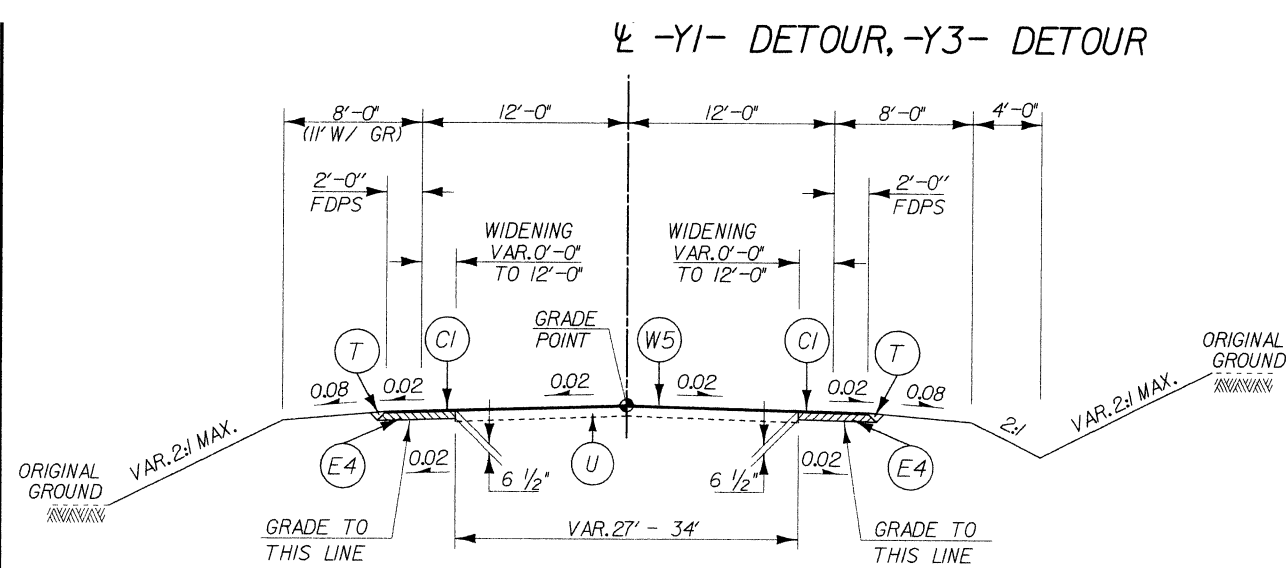
TYPICAL SECTION NO. 14

TRANSITION FROM EXISTING TO T.S. NO. 14 FROM
-Y6- STA. 12+44.81 TO -Y6- STA. 13+25.00
USE TYPICAL SECTION NO. 14 AS FOLLOWS:
FROM -Y6- STA. 13+25.00 TO -Y6- STA. 23+31.90

C1	1 1/2" S9.5B
C2	2 1/2" S9.5B
C3	VAR. DEPTH S9.5B
C4	1 1/2" S12.5C
C5	3" S12.5C
C6	VAR. DEPTH S12.5C
D1	2 1/2" 119.0B
D2	3" 119.0B
D3	3 1/2" 119.0B
D4	4" 119.0B
D5	4 1/2" 119.0B
D6	VAR. DEPTH 119.0B
D7	4" 119.0C
D8	VAR. DEPTH 119.0C
E1	3" B25.0B
E2	3 1/2" B25.0B
E3	4" B25.0B
E4	5" B25.0B
E5	5 1/2" B25.0B
E6	VAR. DEPTH B25.0B
E7	9" B25.0C
E8	VAR. DEPTH B25.0C
J1	6" ABC
J2	10" ABC
J3	VAR. DEPTH ABC
R1	2'-6" CONC. CURB & GUTTER
R2	5' MONO. CONC. ISLAND
R3	CONC. EXPRESS. GUTTER
R4	MOD. CONCRETE EXPRESS. GUTTER
R5	SINGLE FACED CONC. BARRIER
R6	DOUBLE FACED CONC. BARRIER
T	EARTH MATERIAL
U	EXIST. PAVEMENT
W1	WEDGING
W2	WEDGING
W3	WEDGING
W4	WEDGING
W5	WEDGING
W6	WEDGING
W7	WEDGING

NOTES:
1. SEE SHEET 2 FOR DETAILED DESCRIPTION OF PAVEMENT SCHEDULE.
2. ALL PAVEMENT EDGES ARE 1:1 UNLESS OTHERWISE NOTED.

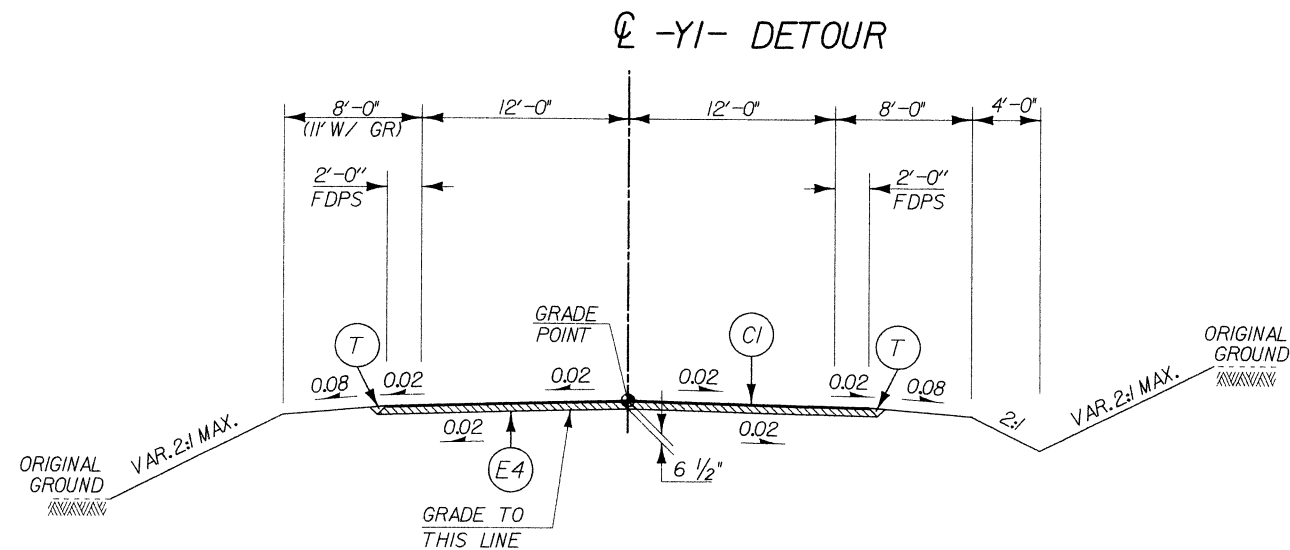
REVISIONS



TYPICAL SECTION NO.15

USE TYPICAL SECTION No.15 AS FOLLOWS:

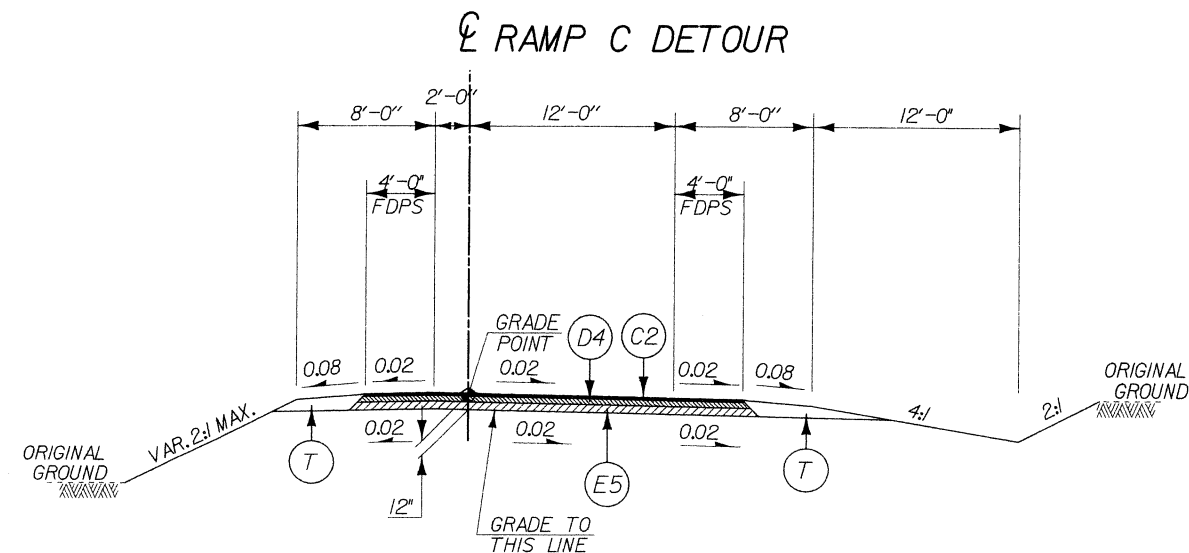
TRANSITION FROM EXISTING TO T.S.No.15 FROM
-Y1-DETOUR STA.14+75.00 TO -Y1-DETOUR STA.15+25.00
FROM -Y1-DETOUR STA.15+25.00 TO -Y1-DETOUR STA.16+54
FROM -Y1-DETOUR STA.18+73 TO -Y1-DETOUR STA.19+50.00
TRANSITION FROM T.S.No.15 TO EXISTING FROM
-Y1-DETOUR STA.19+50.00 TO -Y1-DETOUR STA.20+00.00
TRANSITION FROM EXISTING TO T.S. No.15 FROM
-Y3- DETOUR STA.11+00.00 TO -Y3- DETOUR STA.11+20.00
FROM -Y3- DETOUR STA.11+20.00 TO -Y3- DETOUR STA.11+93.94



TYPICAL SECTION NO.16

USE TYPICAL SECTION No.16 AS FOLLOWS:

FROM -Y1-DETOUR STA.16+54 TO -Y1-DETOUR STA.18+73



TYPICAL SECTION NO.17

USE TYPICAL SECTION No.17 AS FOLLOWS:

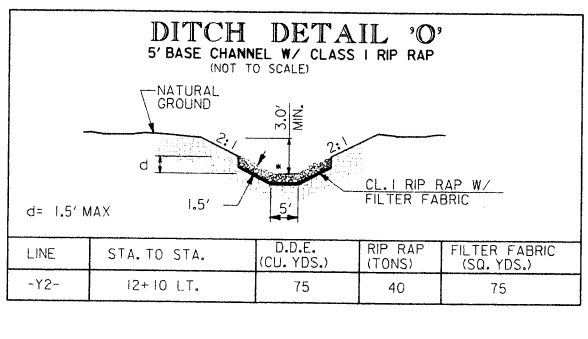
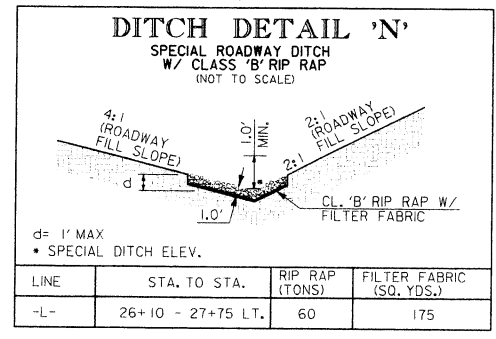
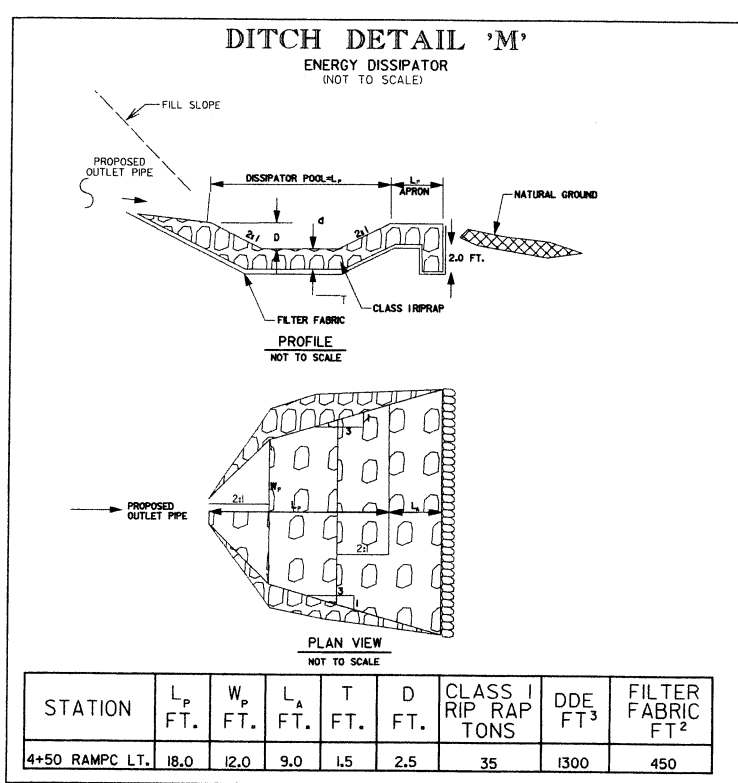
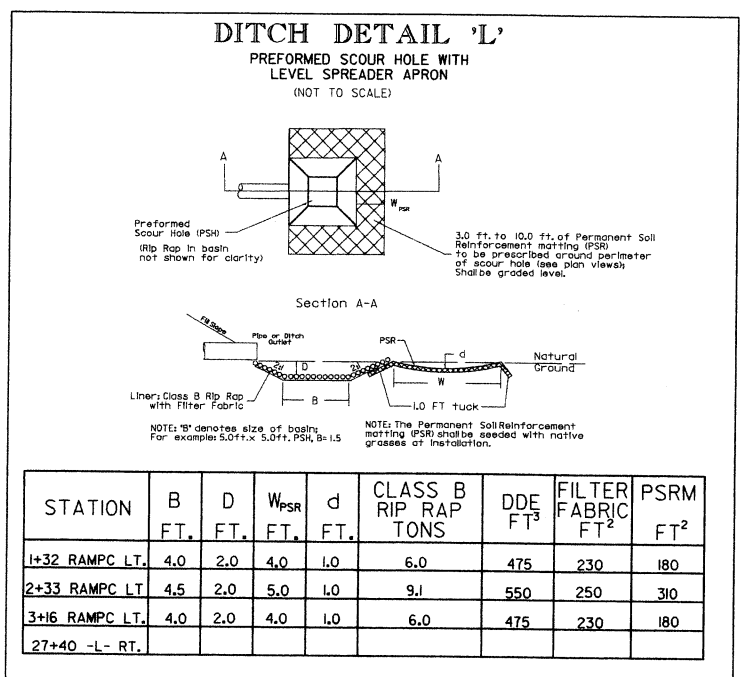
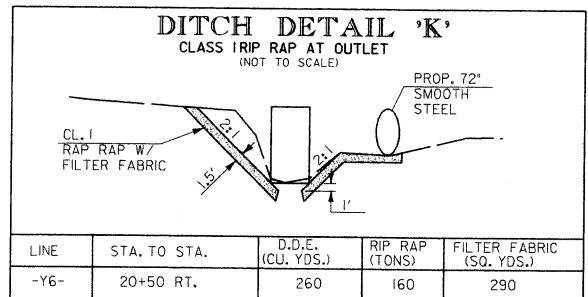
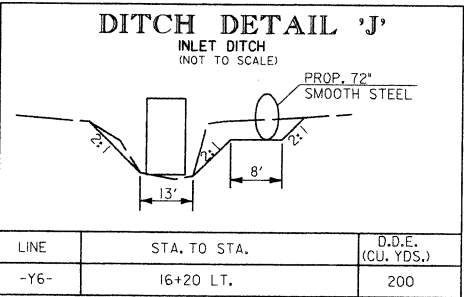
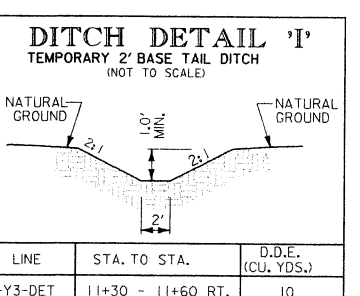
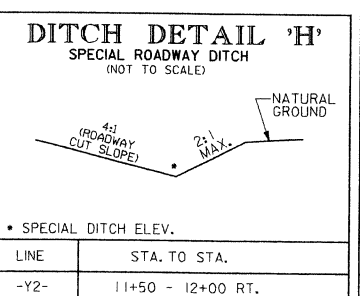
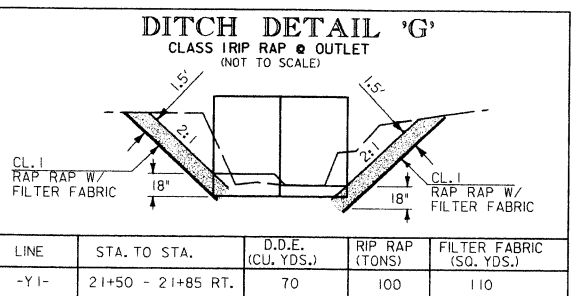
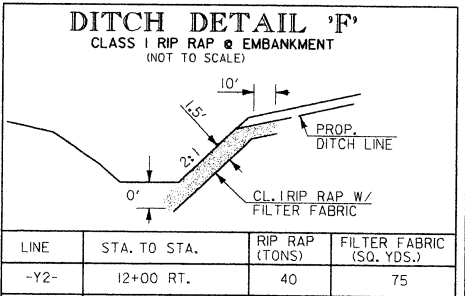
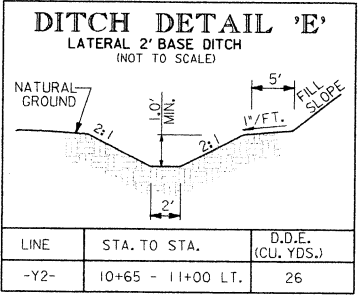
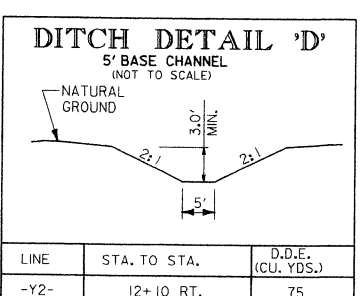
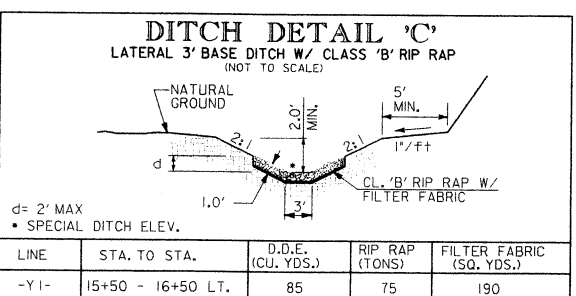
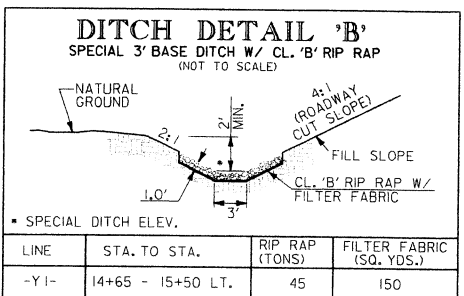
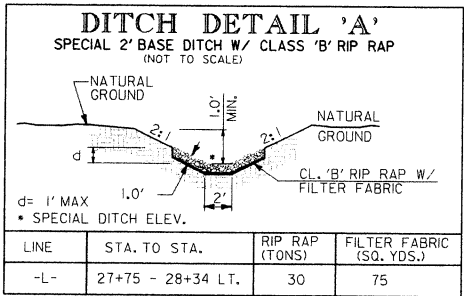
FROM RAMP C DETOUR STA.11+00.29 TO RAMP C DETOUR STA.13+45.39

C1	1 1/2" S9.5B
C2	2 1/2" S9.5B
C3	VAR.DEPTH S9.5B
C4	1 1/2" S12.5C
C5	3" S12.5C
C6	VAR.DEPTH S12.5C
D1	2 1/2" 119.0B
D2	3" 119.0B
D3	3 1/2" 119.0B
D4	4" 119.0B
D5	4 1/2" 119.0B
D6	VAR.DEPTH 119.0B
D7	4" 119.0C
D8	VAR.DEPTH 119.0C
E1	3" B25.0B
E2	3 1/2" B25.0B
E3	4" B25.0B
E4	5" B25.0B
E5	5 1/2" B25.0B
E6	VAR.DEPTH B25.0B
E7	9" B25.0C
E8	VAR.DEPTH B25.0C
J1	6" ABC
J2	10" ABC
J3	VAR.DEPTH ABC
R1	2'-6" CONC. CURB & GUTTER
R2	5' MONO. CONC.ISLAND
R3	CONC. EXPRESS.GUTTER
R4	MOD.CONCRETE EXPRESS.GUTTER
R5	SINGLE FACED CONC.BARRIER
R6	DOUBLE FACED CONC.BARRIER
T	EARTH MATERIAL
U	EXIST.PAVEMENT
W1	WEDGING
W2	WEDGING
W3	WEDGING
W4	WEDGING
W5	WEDGING
W6	WEDGING
W7	WEDGING

NOTE:
1. SEE SHEET 2 FOR DETAILED DESCRIPTION OF PAVEMENT SCHEDULE.
2. ALL PAVEMENT EDGES ARE 1:1 UNLESS OTHERWISE NOTED.

REVISIONS

INCOMPLETE PLANS
DO NOT USE FOR CONSTRUCTION



REVISIONS

DETAIL
TYPICAL FLOOD PLAIN SECTION
(Not to Scale)

VAR. 3' 4% 2:1

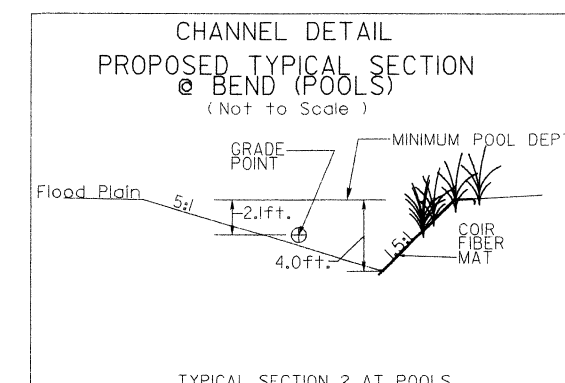
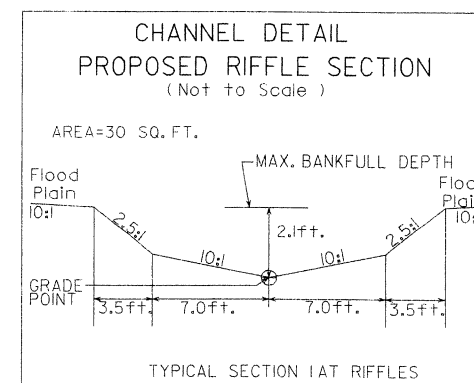
Future Fill Slope

Flood Plain

VAR. 0' TO 100' VAR. 2:1

Natural Ground

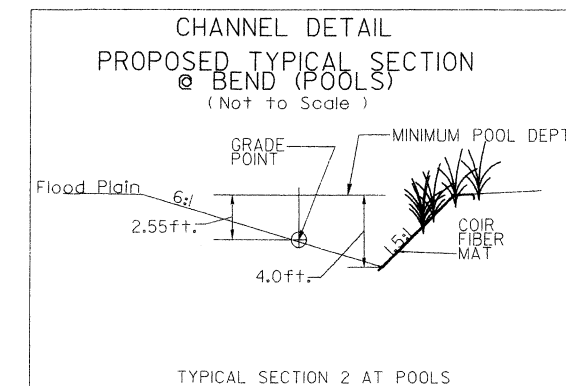
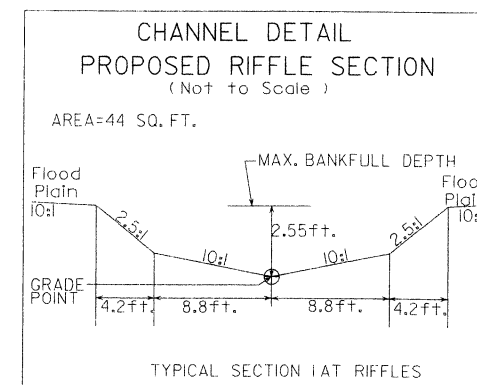
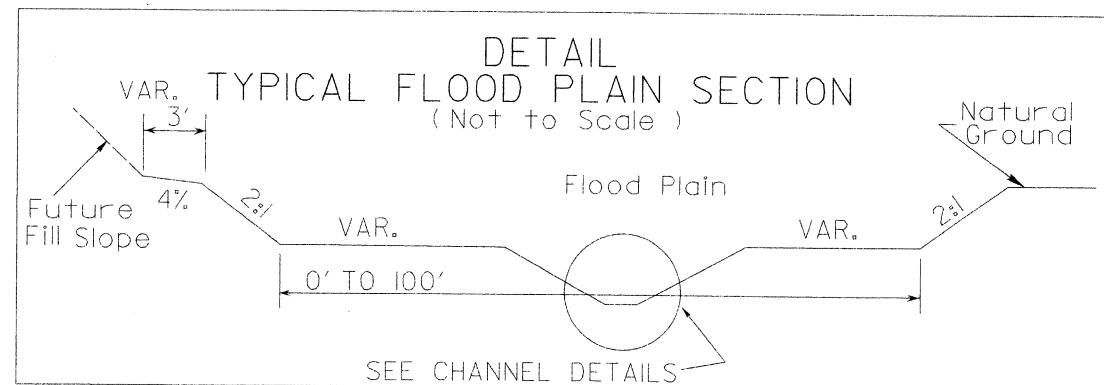
SEE CHANNEL DETAILS



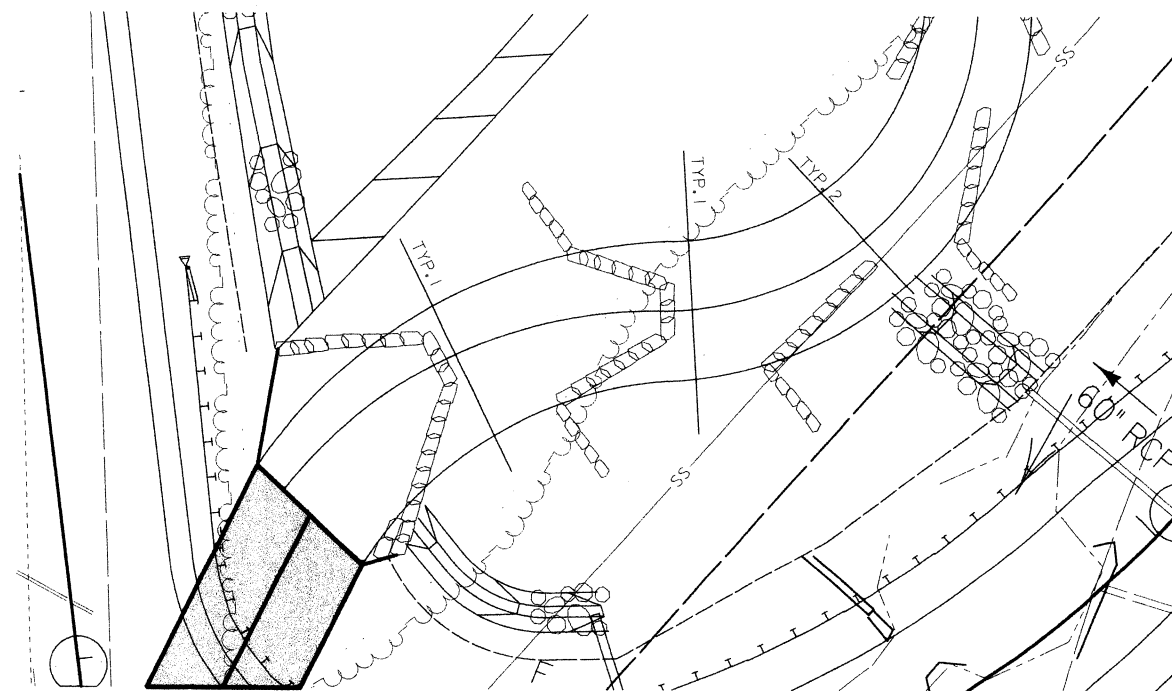
CHANNEL PLAN VIEW
SEGMENT #1
STA. 12+02 TO 14+52 -Y2- LEFT

NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE



QUANTITIES
DDE = 3300CY
BOULDERS = 100@4000LB.
20@2000LB.
COIR FIBER MAT = 120SY
GEOTEXTILE FABRIC = 90SY



CHANNEL PLAN VIEW

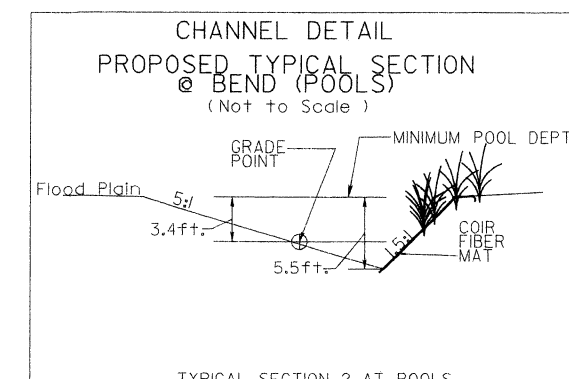
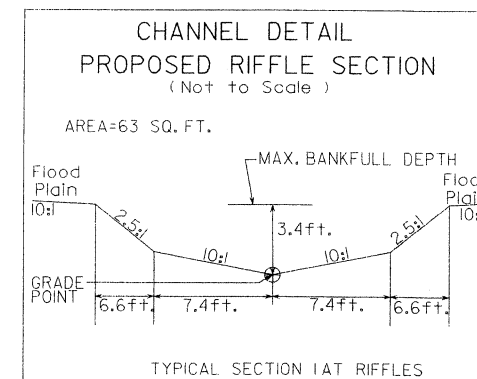
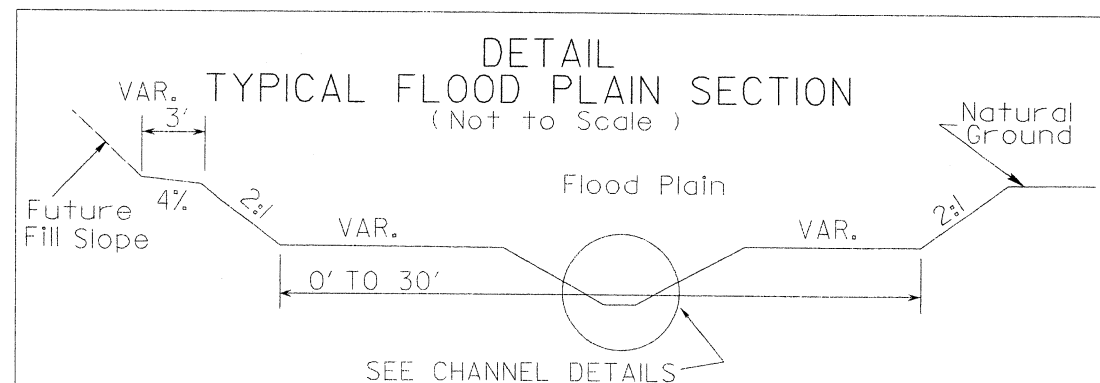
SEGMENT #2

STA. 10+35.6 TO 12+02 -Y2- LEFT

REVISIONS

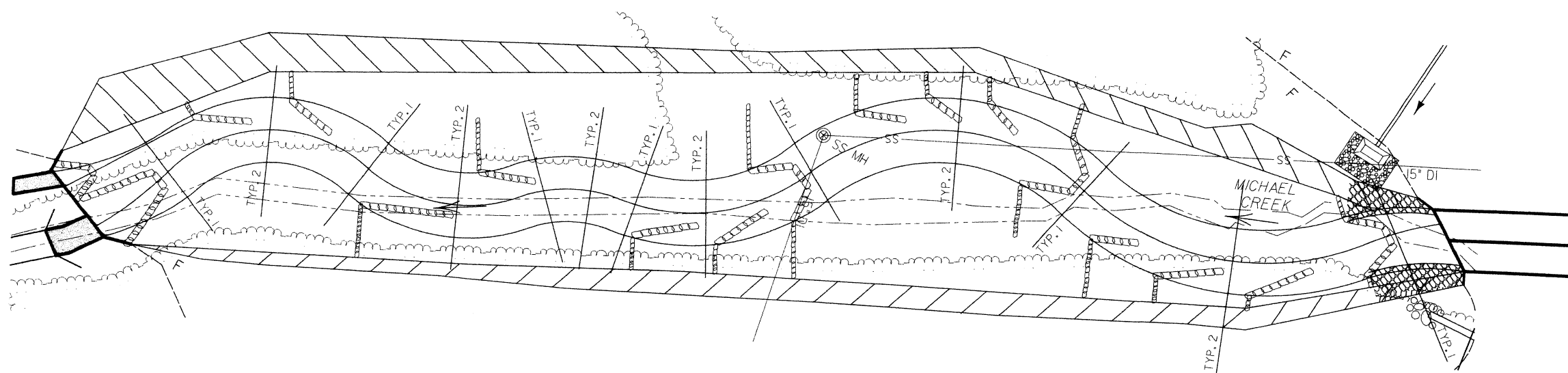
NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE



QUANTITIES

DDE = 14500CY
BOULDERS = 300@4000LB.
270@2000LB.
COIR FIBER MAT = 850SY
GEOTEXTILE FABRIC = 600SY



CHANNEL PLAN VIEW SEGMENT #3

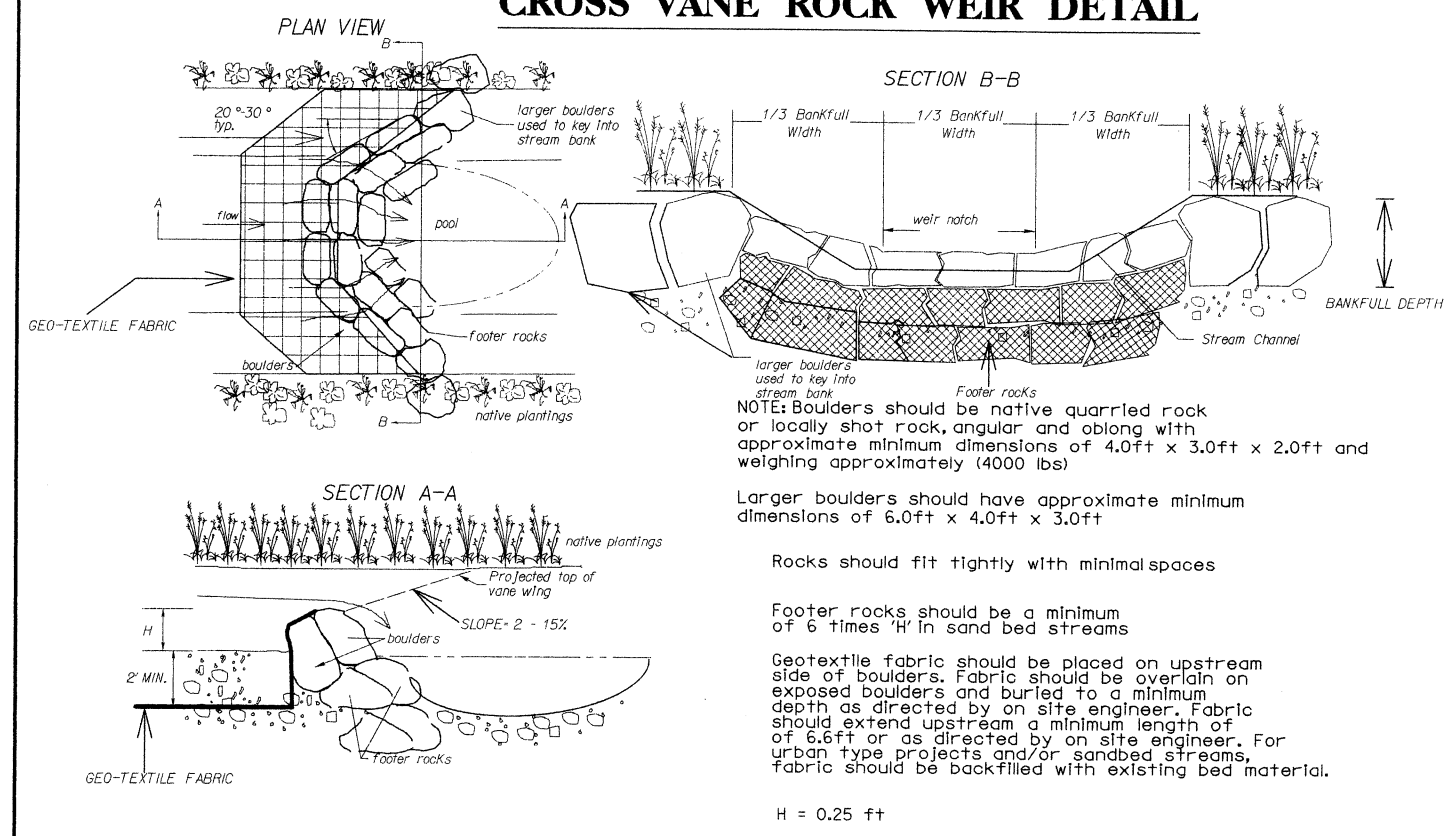
STA. 21+45 TO 25+93.3 -YI- RIGHT

REVISIONS

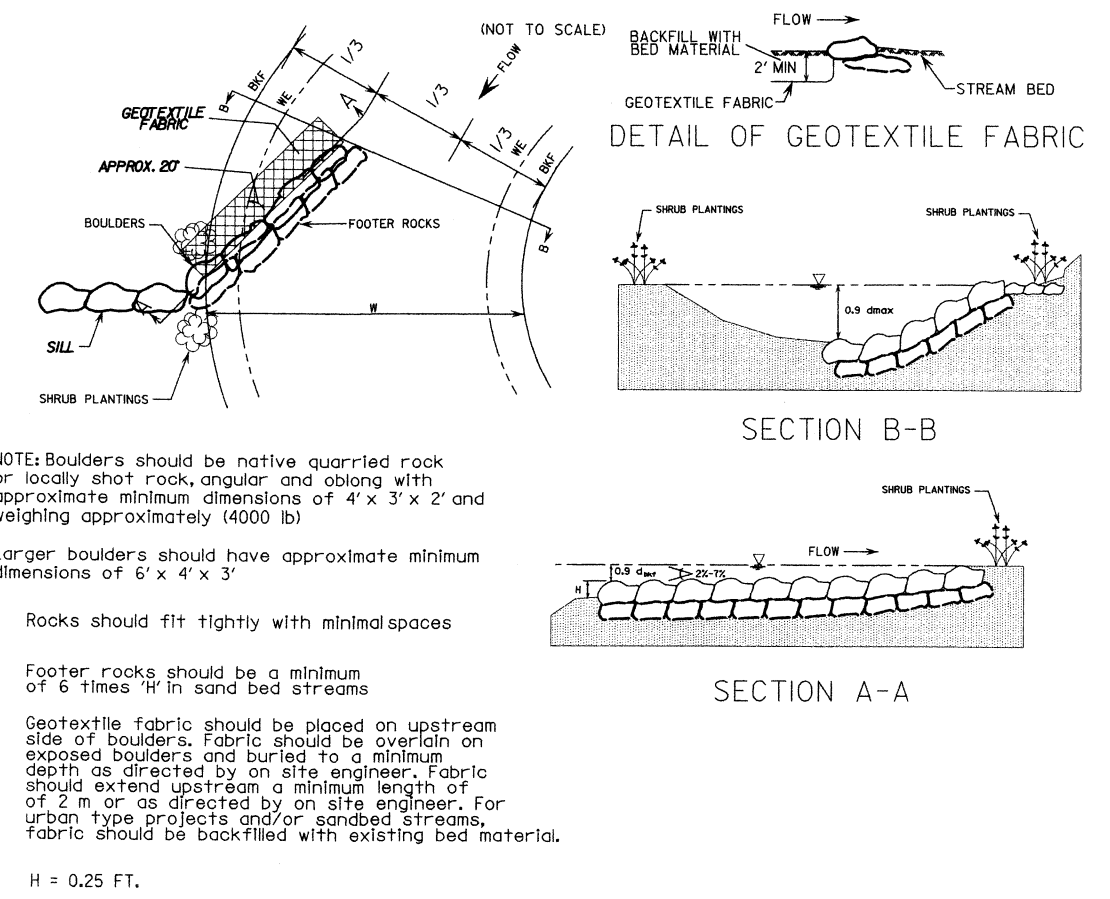
NATURAL CHANNEL DESIGN TYPICALS

NOT TO SCALE

CROSS VANE ROCK WEIR DETAIL



ROCK VANE



CROSS VANE TYPICAL

ROCK VANE TYPICAL

REVISIONS

06/06/2003 02:35:08 PM g:\p\project\2000\2400\B35\Roadway\Proj\B35T.RDY TYP.DGN

MULKEY

ENGINEERS & CONSULTANTS

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RACON, N.C. 27636

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PROJECT REFERENCE NO.
B-3157

SHEET NO.
2-N

HYDRAULICS
ENGINEER

ROADWAY DESIGN
ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR CONSTRUCTION

SEGMENT #1

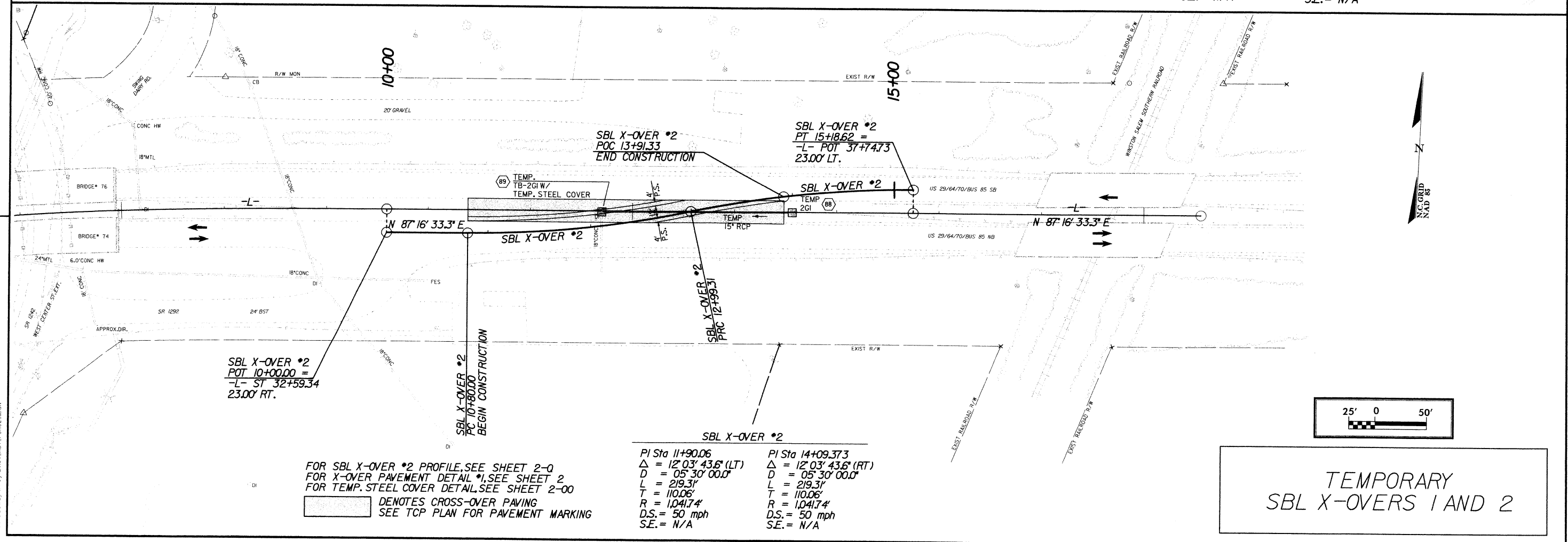
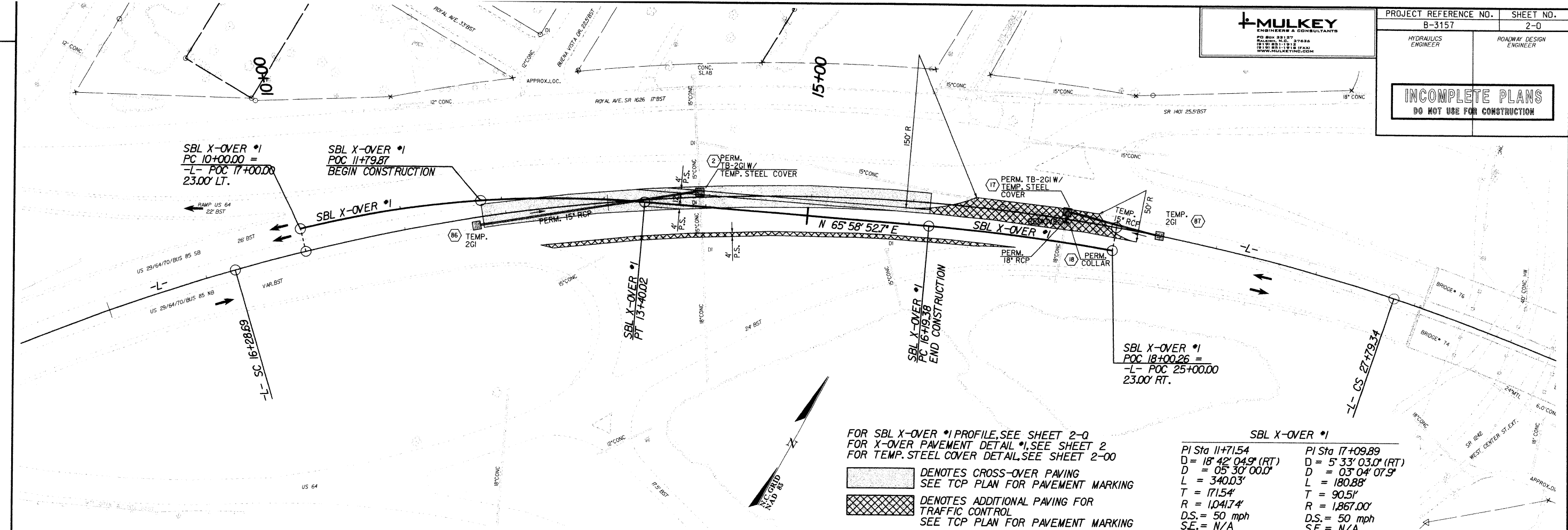
	STA. (-Y2-)	OFFSET	Rc	Lc	GRADE POINT ELEVATION	BANKFULL ELEVATION
PC	14+37.6	47.0' RT			715.5'	717.8'
PI	13+99.6	43.2' RT	126.5'	100.4'		
PT	13+73.4	84.9' RT			714.6'	716.9'
PC	13+73.4	84.9' RT			714.6'	716.9'
PI	13+16.0	165.3' RT	77.5'	140.4'		
PT	12+51.6	90.3' RT			713.4'	715.7'
PC	12+51.6	90.3' RT			713.4'	715.7'
PI	12+11.8	47.0' RT	55.7'	86.8'		
PT	11+45.0	84.0' RT			712.6'	714.9'

SEGMENT #2

	STA. (-Y2-)	OFFSET	Rc	Lc	GRADE POINT ELEVATION	BANKFULL ELEVATION
PC	14+45.0	84.0' RT			712.6'	714.9'
PI	10+73.6	99.4' RT	80.0'	76.3'		
PT	10+35.6	68.4' RT			712.0'	714.3'

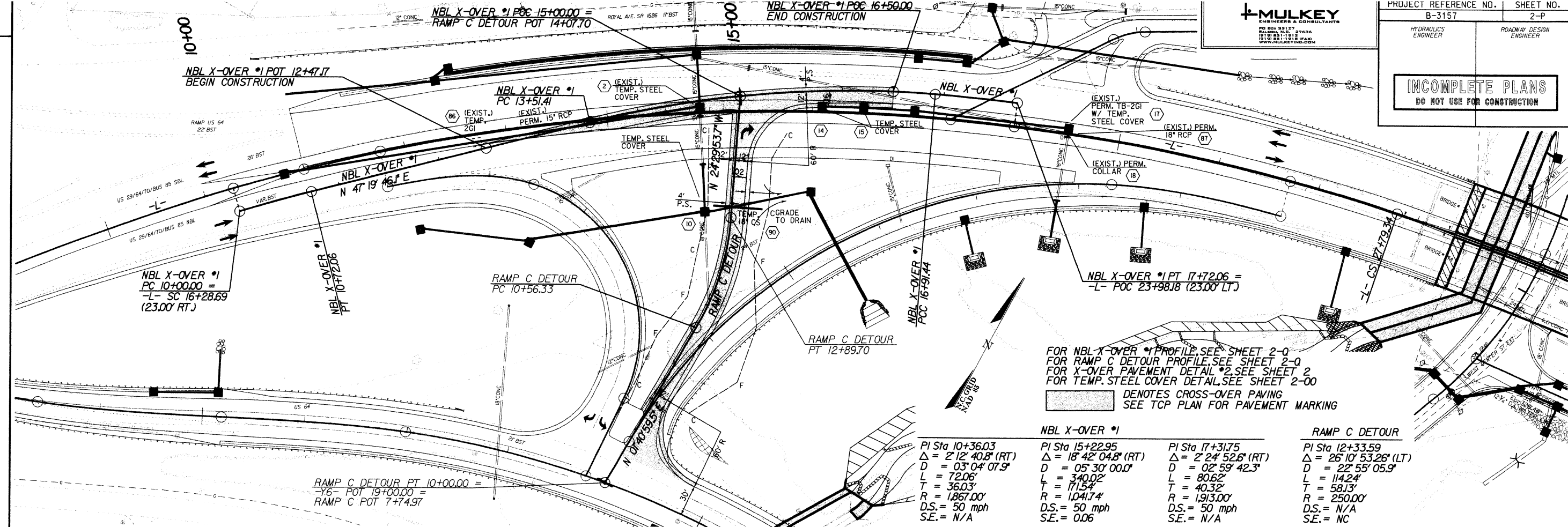
SEGMENT #3

	STA. (-Y1-)	OFFSET	Rc	Lc	GRADE POINT ELEVATION	BANKFULL ELEVATION
PC	21+45.0	95.1' RT			710.60'	712.90'
PI	21+59.8	98.2' RT	130.0'	30.9'		
PT	21+75.3	97.6' RT			710.40'	712.70'
PC	21+75.3	97.6' RT			710.40'	712.70'
PI	22+41.8	96.1' RT	100.0'	117.5'		
PT	22+66.4	157.2' RT			710.25'	712.55'
PC	22+66.4	157.2' RT			710.25'	712.55'
PI	22+95.7	218.9' RT	80.0'	114.2'		
PT	23+56.7	197.7' RT			710.00'	712.30'
PC	23+56.7	197.7' RT			710.00'	712.30'
PI	23+92.8	190.1' RT	75.0'	72.8'		
PT	24+18.5	218.2' RT			709.70'	712.00'
PC	24+18.5	218.2' RT			709.70'	712.00'
PI	24+30.6	231.9' RT	55.0'	36.5'		
PT	24+47.8	234.7' RT			709.60'	711.90'
PC	24+47.8	234.7' RT			709.60'	711.90'
PI	24+79.9	237.1' RT	60'	63.5'		
PT	24+93.3	269.0' RT			709.40'	711.70'
PC	24+93.3	269.0' RT			709.40'	711.70'
PI	25+10.4	320.3' RT	55.0'	86.2'		
PT	25+56.4	302.0' RT			709.15'	711.45'
PC	25+56.4	302.0' RT			709.15'	711.45'
PI	25+80.0	297.4' RT	150.0'	33.8'		
PT	25+86.1	296.6' RT			709.00'	711.30'



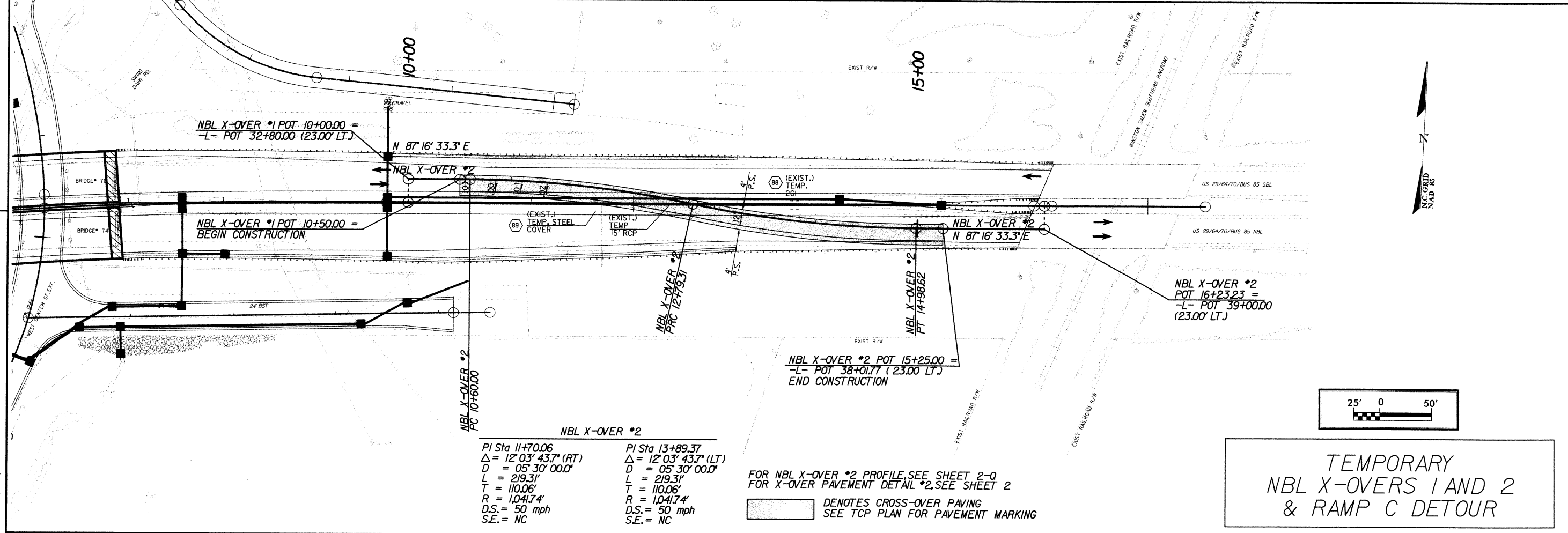
TEMPORARY
SBL X-OVERS 1 AND 2

REVISIONS



FOR NBL X-OVER #1 PROFILE, SEE SHEET 2-0
FOR RAMP C DETOUR PROFILE, SEE SHEET 2-0
FOR X-OVER PAVEMENT DETAIL #2, SEE SHEET 2
FOR TEMP. STEEL COVER DETAIL, SEE SHEET 2-00
DENOTES CROSS-OVER PAVING
SEE TCP PLAN FOR PAVEMENT MARKING

NBL X-OVER #1		RAMP C DETOUR	
PI Sta 10+36.03	PI Sta 15+22.95	PI Sta 17+31.75	PI Sta 12+33.59
$\Delta = 2' 12' 40.8''$ (RT)	$\Delta = 18' 42' 04.8''$ (RT)	$\Delta = 2' 24' 52.8''$ (RT)	$\Delta = 26' 10' 53.26''$ (LT)
D = 03' 04' 07.9'	D = 05' 30' 00.0'	D = 02' 59' 42.3'	D = 22' 55' 05.9'
L = 72.06'	L = 340.02'	L = 80.62'	L = 114.24'
T = 36.03'	T = 171.54'	T = 40.32'	T = 58.13'
R = 1,867.00'	R = 1,041.74'	R = 1,913.00'	R = 250.00'
D.S. = 50 mph	D.S. = 50 mph	D.S. = 50 mph	D.S. = N/A
S.E. = N/A	S.E. = 0.06	S.E. = N/A	S.E. = NC

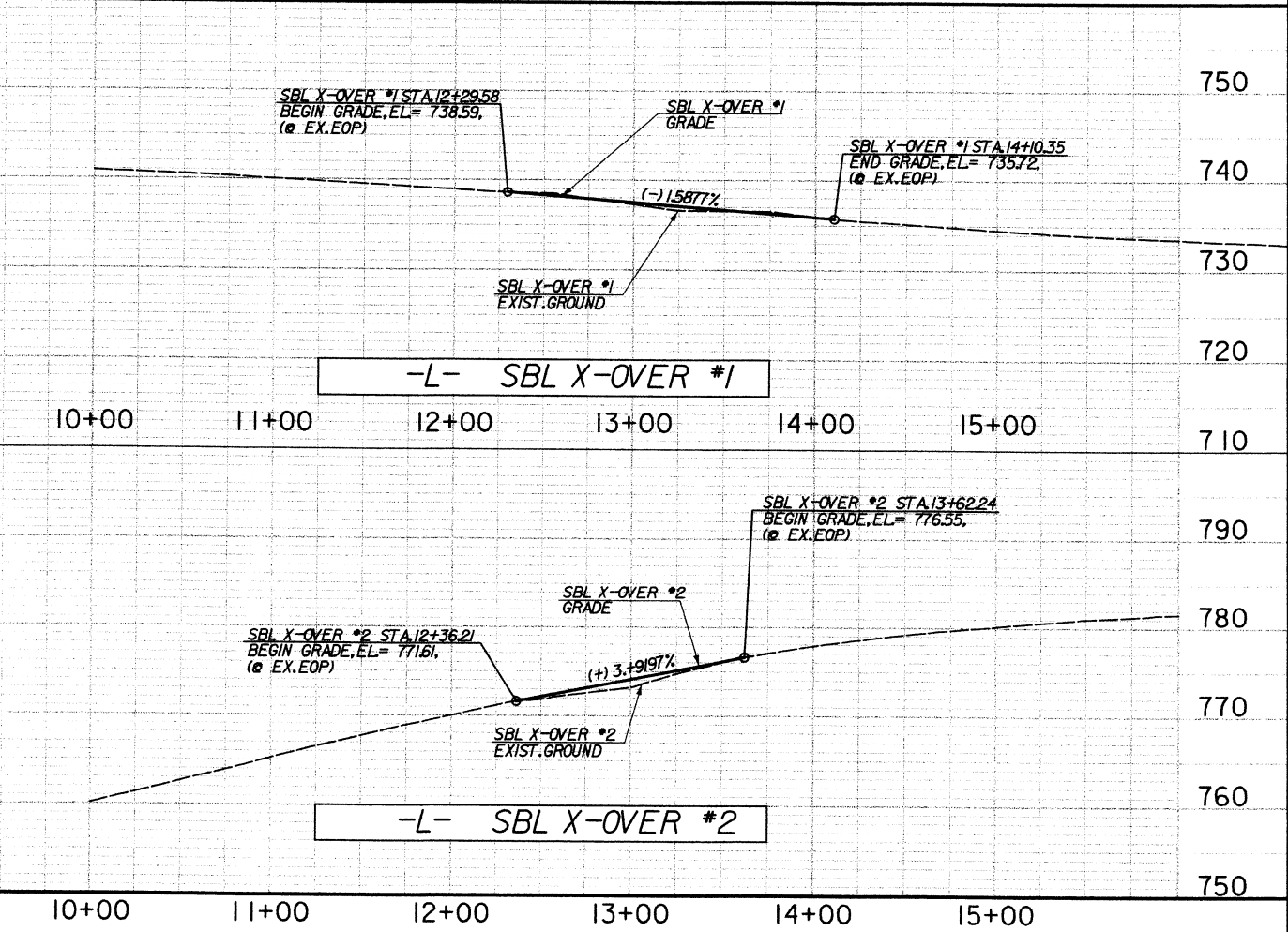
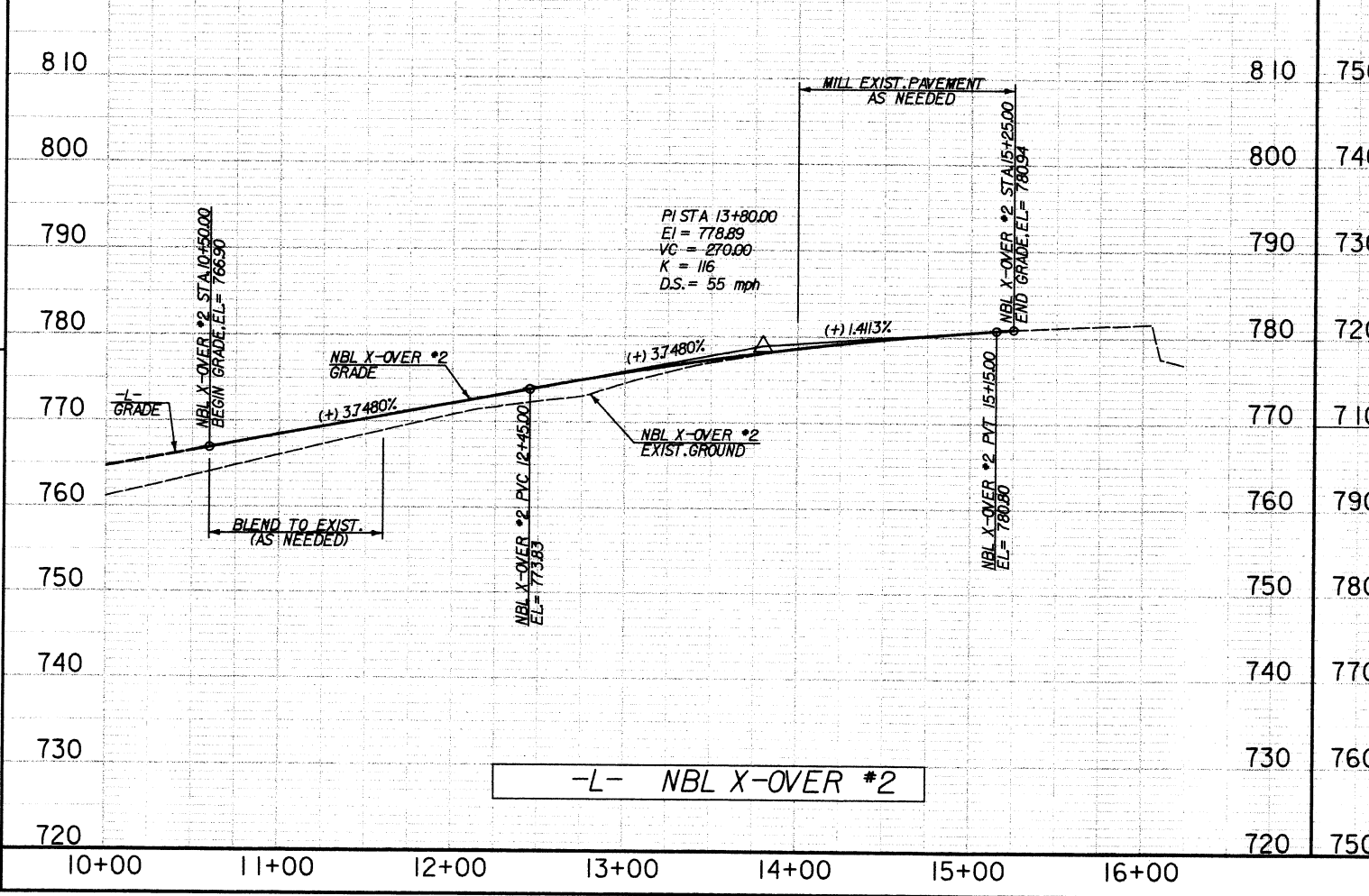
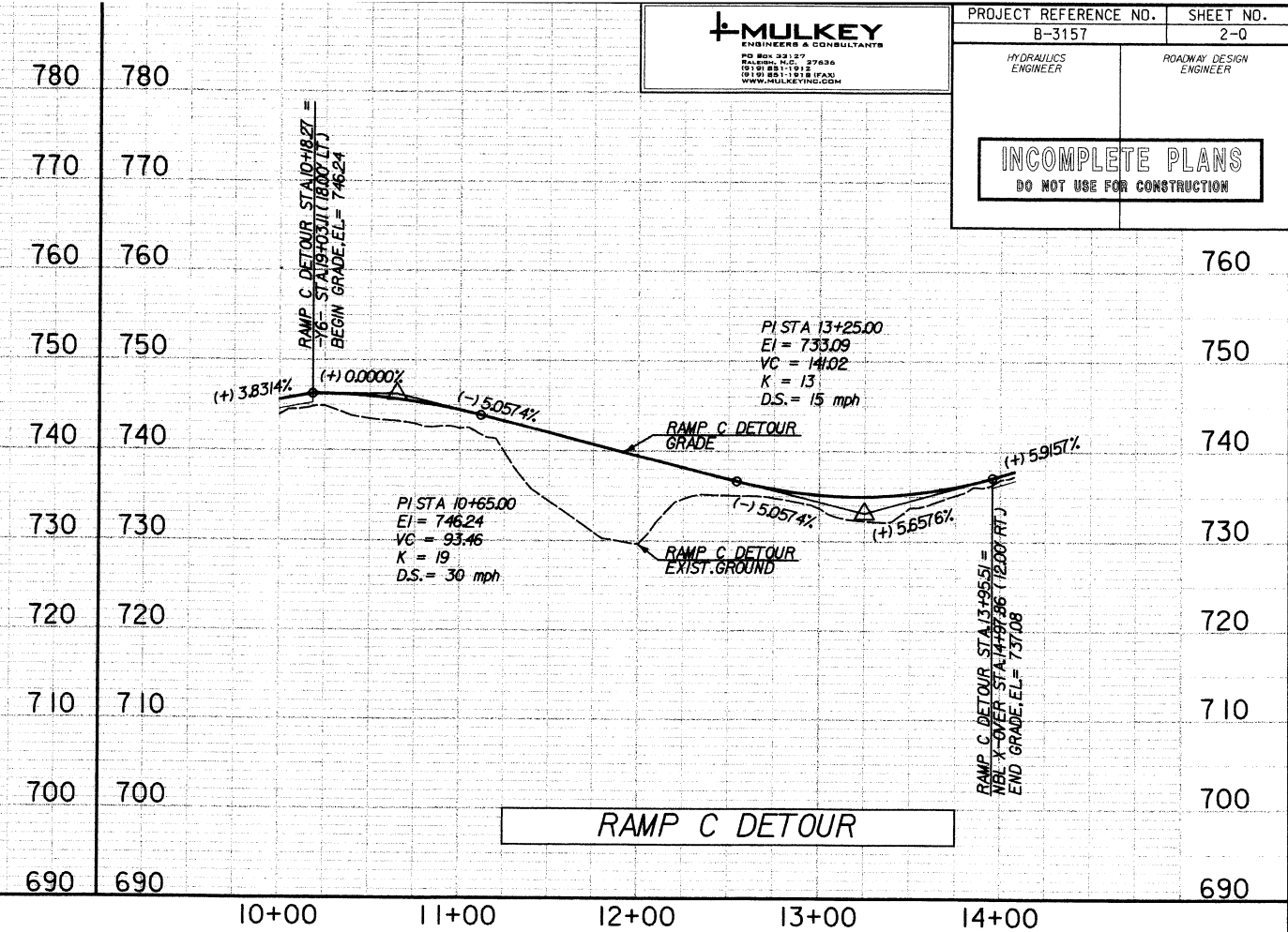
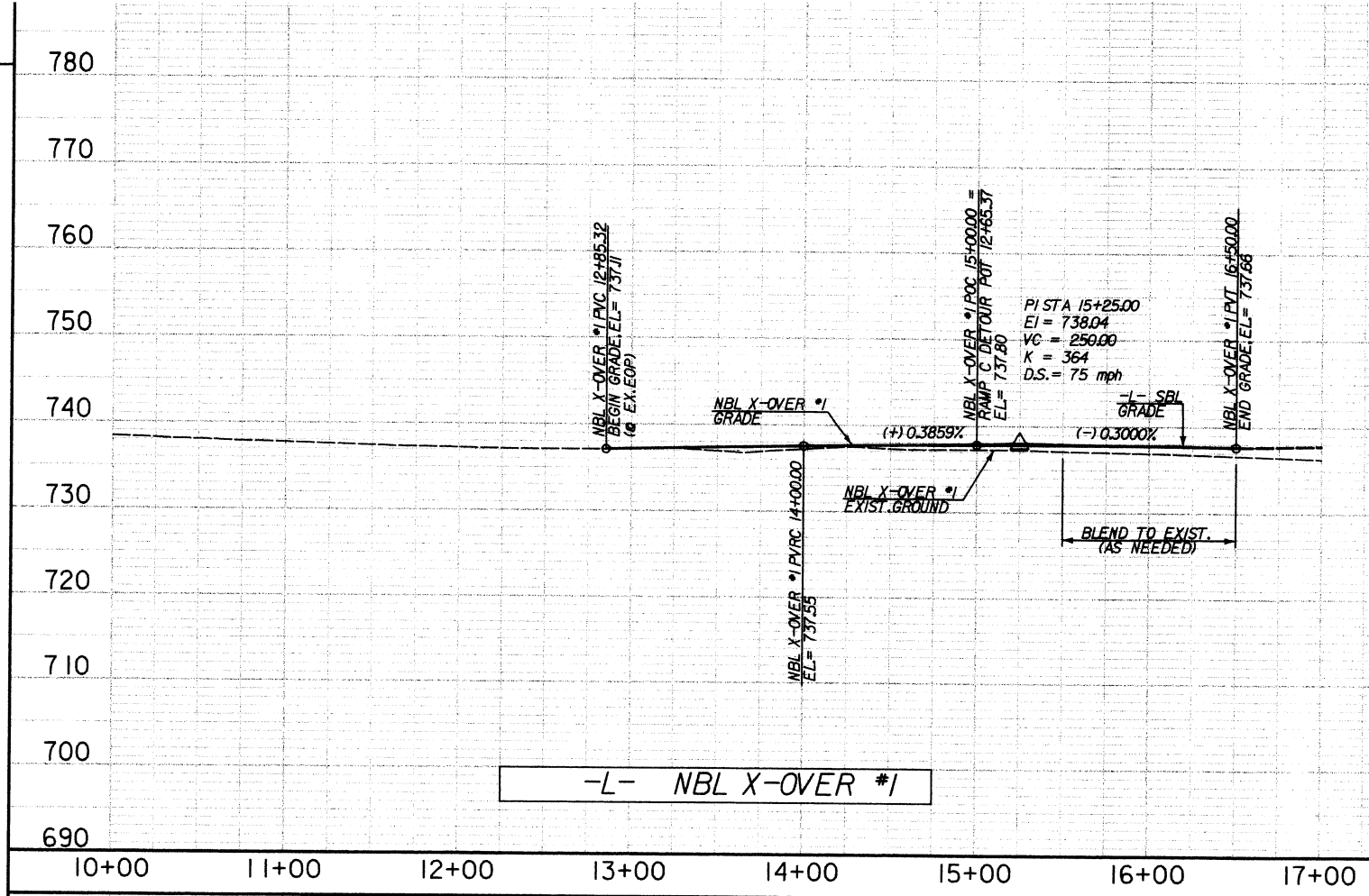


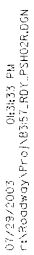
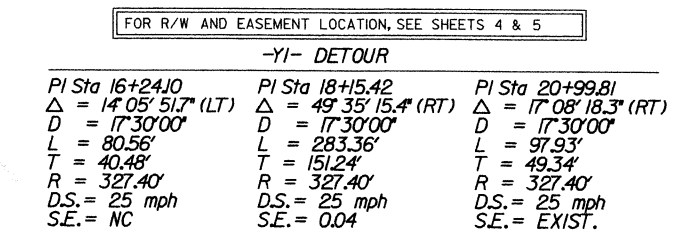
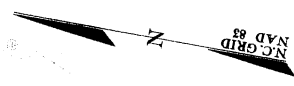
FOR NBL X-OVER #2 PROFILE, SEE SHEET 2-0
FOR X-OVER PAVEMENT DETAIL #2, SEE SHEET 2
DENOTES CROSS-OVER PAVING
SEE TCP PLAN FOR PAVEMENT MARKING

NBL X-OVER #2	
PI Sta 11+70.06	PI Sta 13+89.37
$\Delta = 12' 03' 43.7''$ (RT)	$\Delta = 12' 03' 43.7''$ (LT)
D = 05' 30' 00.0'	D = 05' 30' 00.0'
L = 219.31'	L = 219.31'
T = 110.06'	T = 110.06'
R = 1,041.74'	R = 1,041.74'
D.S. = 50 mph	D.S. = 50 mph
S.E. = NC	S.E. = NC

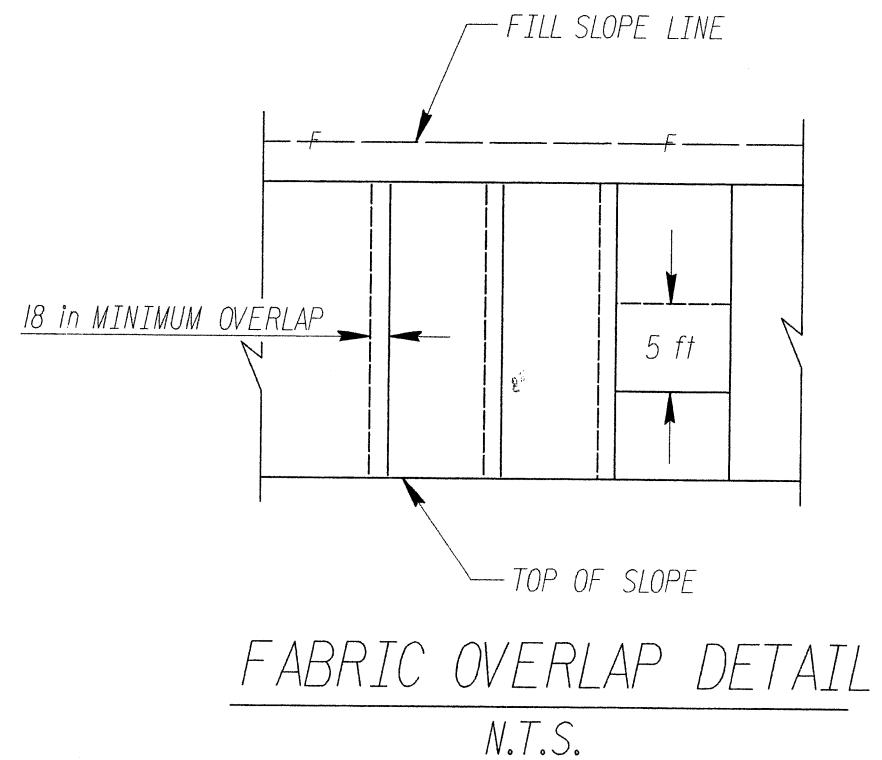
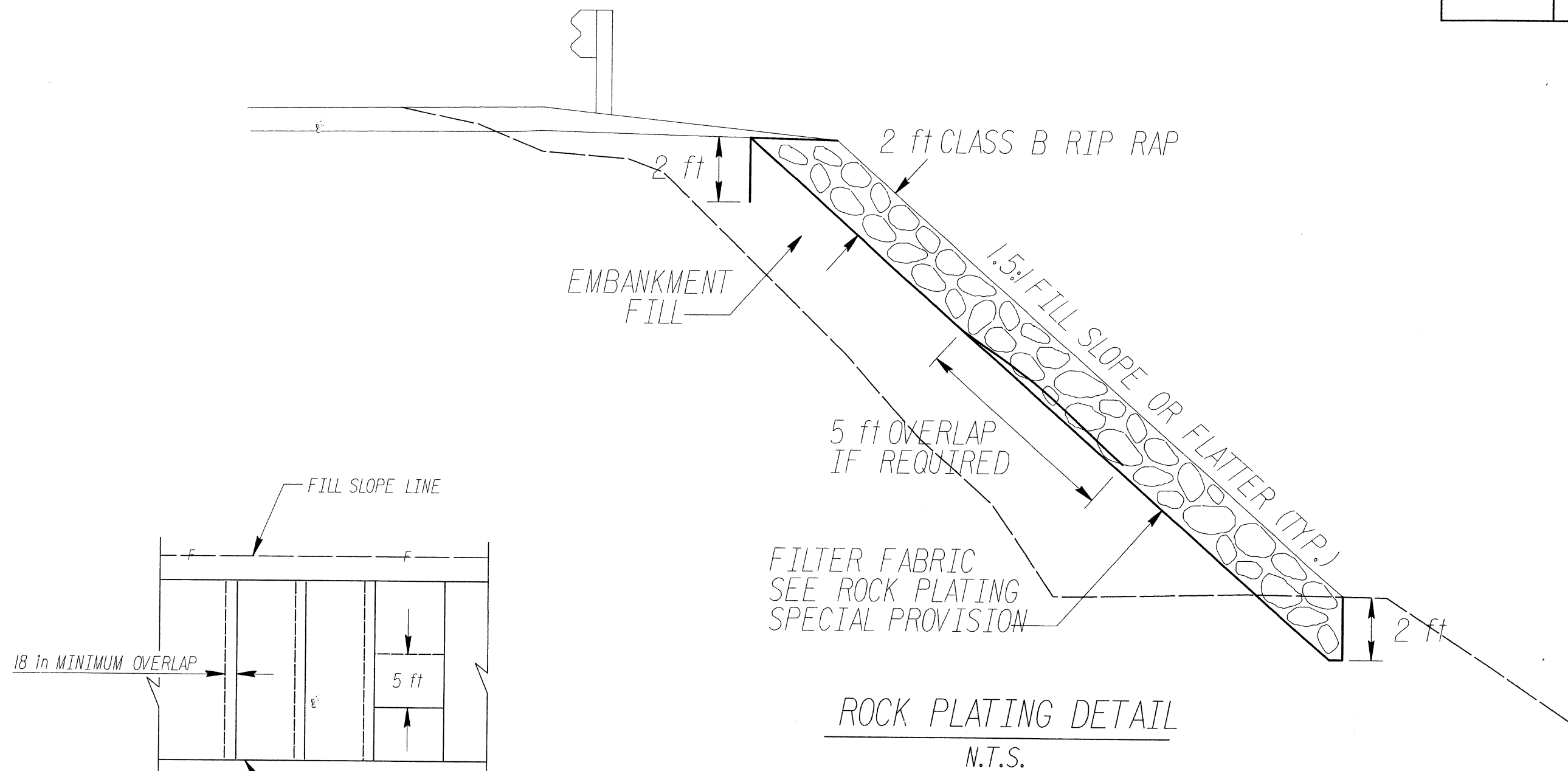
TEMPORARY
NBL X-OVERS 1 AND 2
& RAMP C DETOUR

REVISIONS





PROJECT REFERENCE NO.	SHEET NO.
B-3157	2.5
	SOILS & FOUNDATION DESIGN ENGINEER

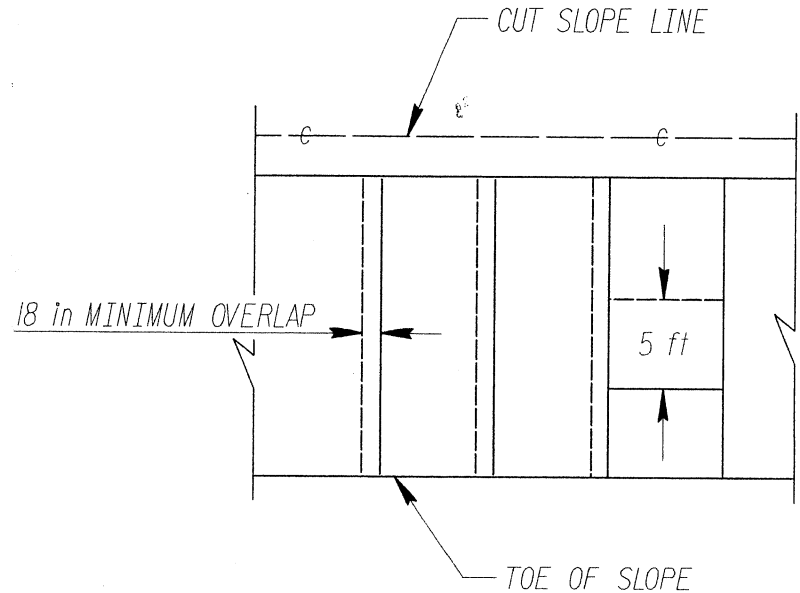


PROJECT B-3157
DAVIDSON COUNTY
 STATIONS 13+50 TO 16+50 -Y6-, RT

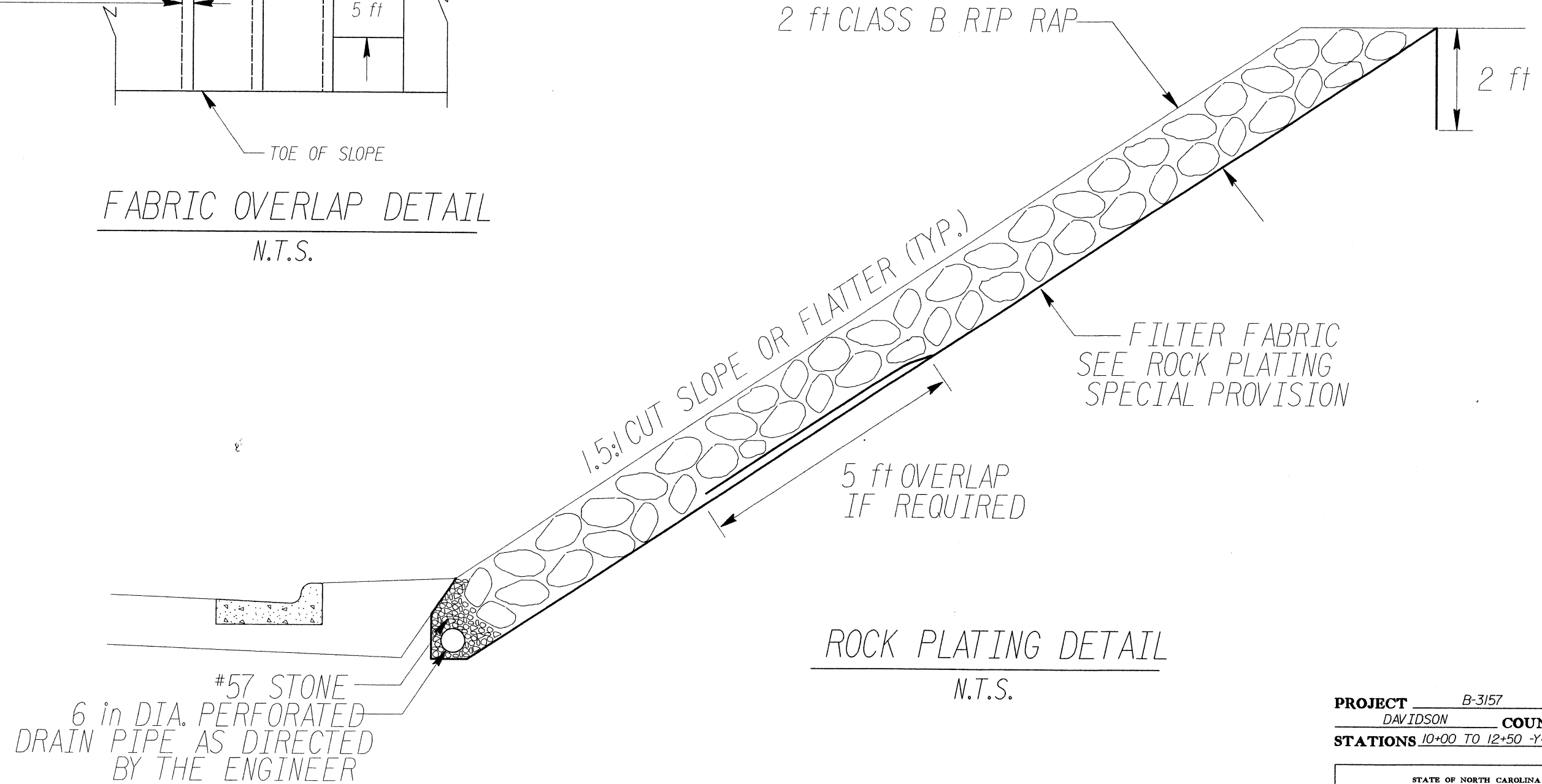
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 TYPICAL ROCK
 PLATING CROSS
 SECTION

DRAWN BY SAH DATE 11/2002
 CHECKED BY CAK DATE 11/2002

PROJECT REFERENCE NO.	SHEET NO.
B-3157	2-T
	SOIL & FOUNDATION DESIGN ENGINEER



FABRIC OVERLAP DETAIL
N.T.S.

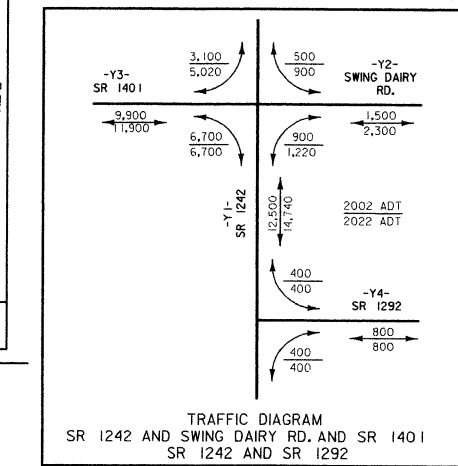


ROCK PLATING DETAIL
N.T.S.

PROJECT B-3157
DAVIDSON COUNTY
STATIONS 10+00 TO 12+50 -Y4-, RT

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
**TYPICAL ROCK
PLATING CROSS
SECTION**

DRAWN BY SAH DATE 11/2002
CHECKED BY CAK DATE 11/2002

[illegible]

11+25.00 =
11 10+00.00
+00.97
+50.80
4+76.08 =
+64.46 =
+28.28 =

35+00

6
CITY OF LEXINGTON
DB 498 PG 710

POS.31,58.83 RT.

DRIVE *1 PT 12+68.03
-L- POS 29+87.18 (11.00' LT.)
END BRIDGE
-L- POS 29+98.15 (11.00' LT.)
END APPROACH SLAB

Hand-drawn site plan of the Wood Gangly site. The plan shows a rectangular area divided into sections labeled "SAND", "PLAYGROUND (SAND)", "CONC", and "WOOD GANGLY W/ CONC FLOOR". A dashed line runs diagonally across the site. A north arrow is located in the upper left corner. A scale bar at the bottom left indicates a distance of 0.00.00 DE *1. A note at the bottom right reads "-L- POT 38+ END STATE H".

DRIVE • STA 15+20.00
END CONSTRUCTION

LINE DITCH W/ PERM. SOIL REINF. MATTING EST 500 yd²

+00.00 END SHOULDER BERM GUTTER - 17'

PROPOSED DOUBLE FACED CONCRETE BARRIER

NC 0' 0' 0' 0' 2' 24"

54' 26W/ FLAT GRA

300' TAPER - RT.
14- POT 14+146
END CONSTRUCTION
POT 14+50.00
END EXPRESS.
GUYER - RT.

STANLEY INTER.
DB 804 PG

-L-		DRIVE °	
P/ Sta 22+22.47	P/ Sta 29+39.58	P/ Sta 11+94.59	
Δ = 34° 52' 55.7" (RT)	Θs = 7° 16' 32.4"	Δ = 44° 26' 59.4"	

$D = 03^{\circ}01'53.5''$	$Ls = 480.00'$	$D = 28^{\circ}38'52.4''$
$L = 1150.65'$	$ST = 160.25'$	$L = 155.16'$
$T = 593.78'$	$LT = 320.27'$	$T = 817.2'$
$R = 1890.00'$		$R = 200.00'$
$Ss = 0.06$		$Ss = NC$

-YI-

$PI\ Stn\ 18+31.67$	$PI\ Stn\ 20+49.42$	$PI\ Stn\ 23+88.05$
---------------------	---------------------	---------------------

$\Delta = 25^{\circ}42'00.8''$ (RT)	$\Delta = 28^{\circ}55'41.0''$ (RT)	$\Delta = 07^{\circ}24'30.8''$ (LT)
$D = 10^{\circ}00'00.0''$	$D = 15^{\circ}00'00.0''$	$D = 02^{\circ}15'00.0''$
$L = 257.00$	$L = 179.52$	$L = 329.27$
$T = 130.70$	$T = 91.45$	$T = 164.86$
$R = 572.96$	$R = 381.97$	$R = 2,546.48$
$Se = 0.04$	$Se = 0.04$	$Se = EXIST.$

Figure 10.10 consists of two diagrams illustrating the intersection of two lines. The left diagram shows a line with a bearing of $44^{\circ} 20' 45.5''$ (LT) and a distance of $283.8524'$. The right diagram shows a line with a bearing of $48^{\circ} 25' 50.2''$ (RT) and a distance of $492.3345'$. Both diagrams show the intersection point and the resulting line segment.

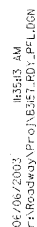
REVISIONS

MATCHLINE TO SHEET 4
STATION 27+00

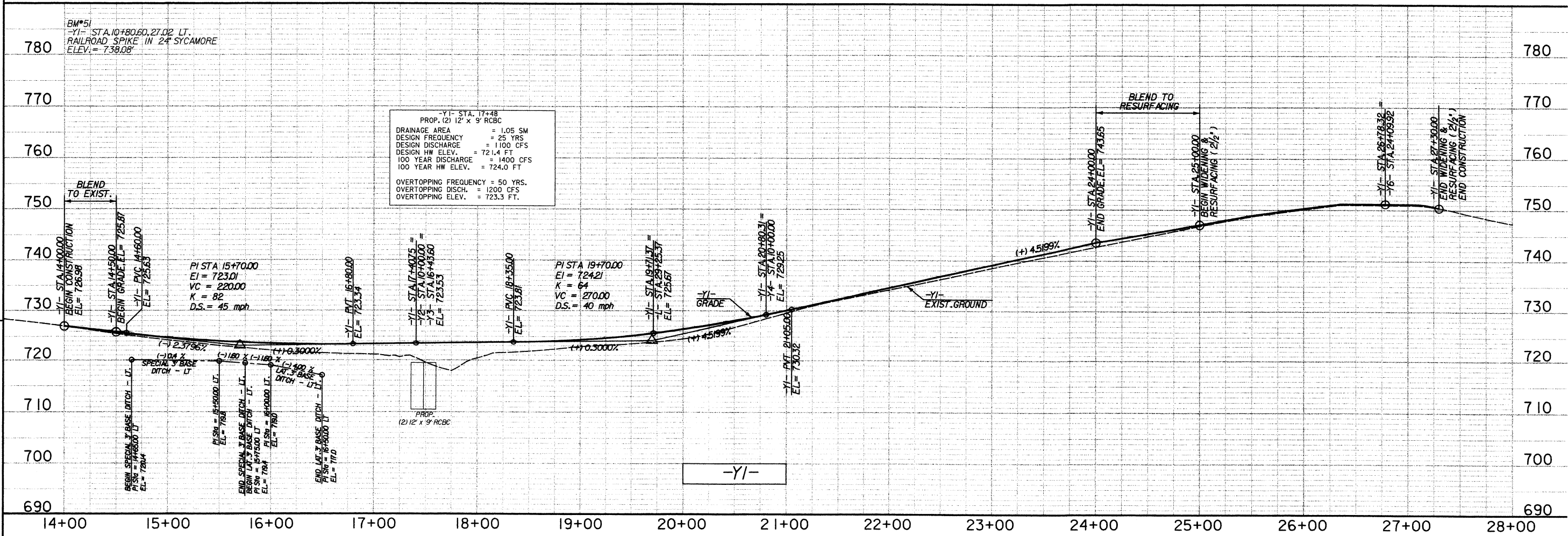
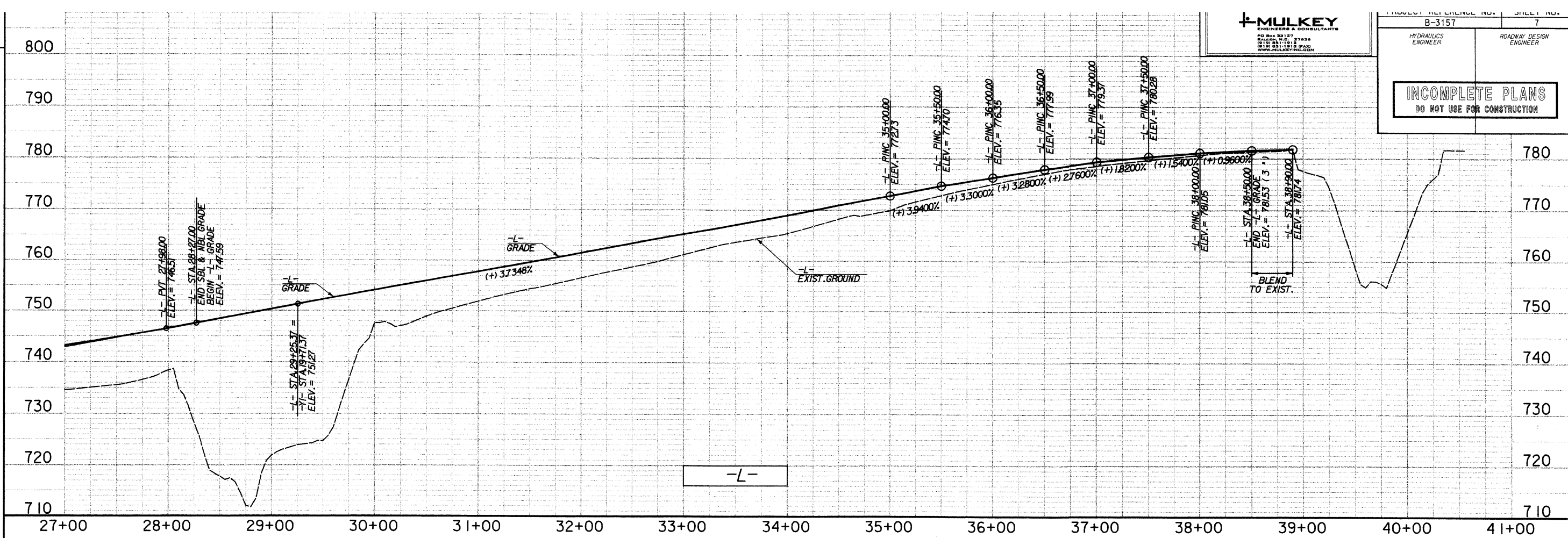
IF
MATCHLINE

UTILITIES WITHIN THE PERIMETER
FENCE FOR STANLEY FURNITURE IS
NOT BEEN DEPICTED.
CONTACT MR. DAVID KEIGER OF
STANLEY FURNITURE FOR UTILI-
TY INFORMATION. (336) 248-5961.

08/11/2003 01:41:56 PM
C:\Program Files\Internet Explorer\IEXPLOE~1\B3573DDWY\PrGj\B3573DDWY_PSH05.DCN



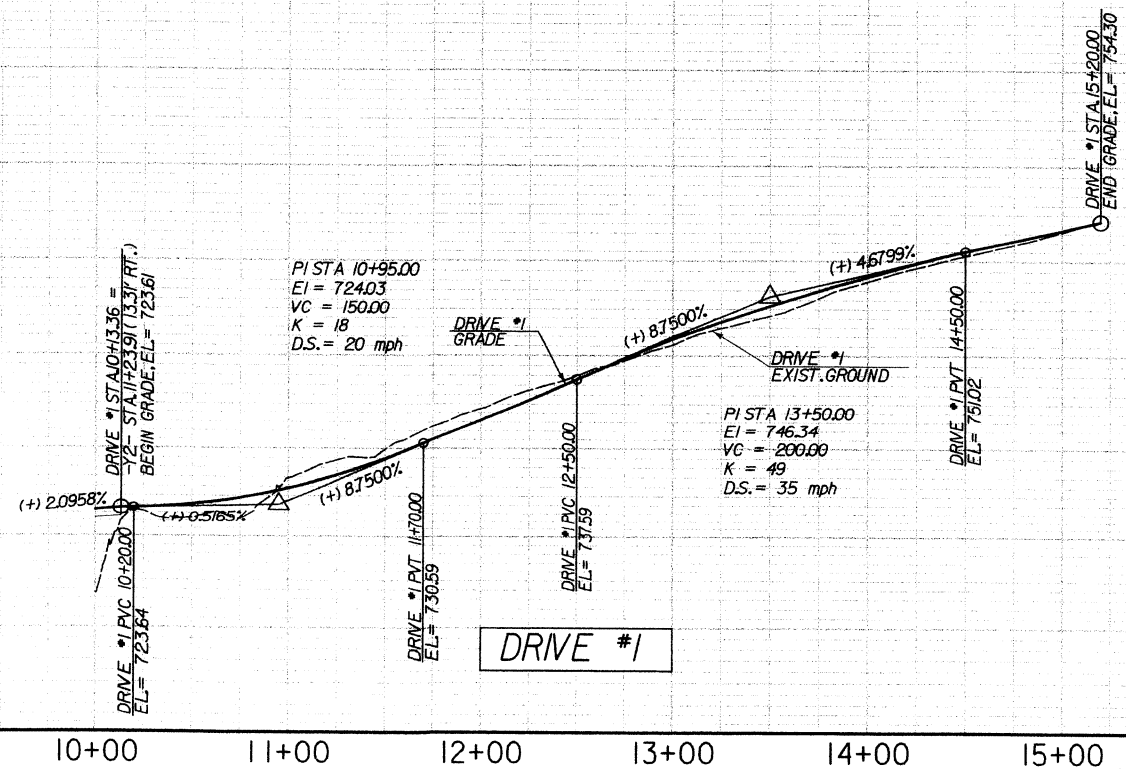
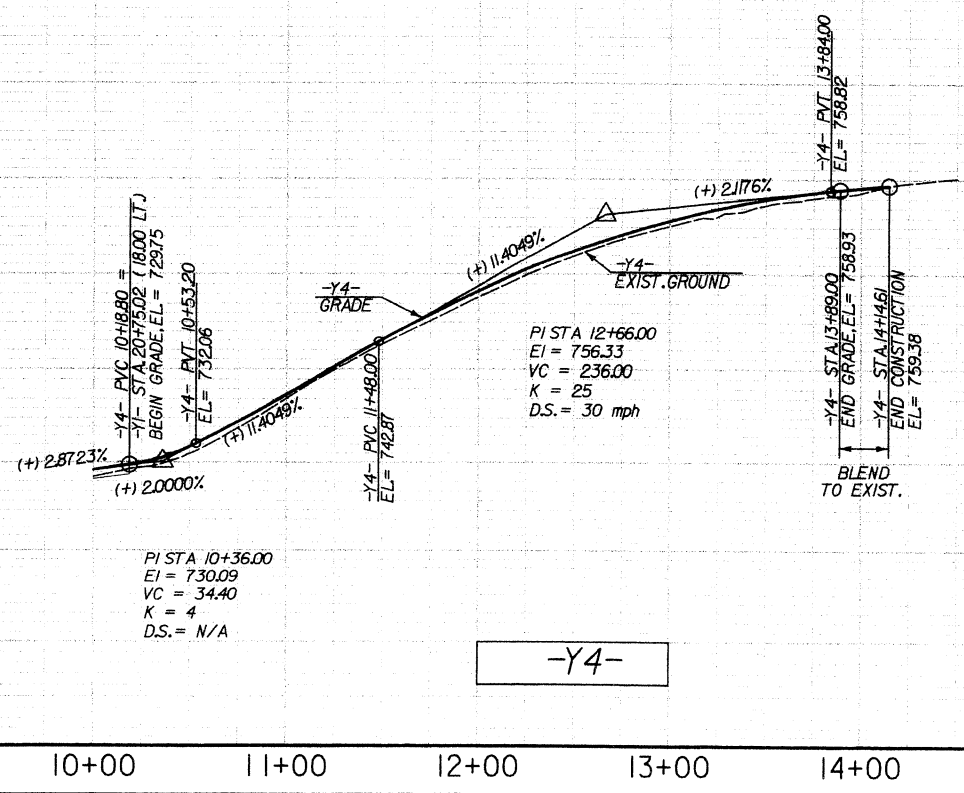
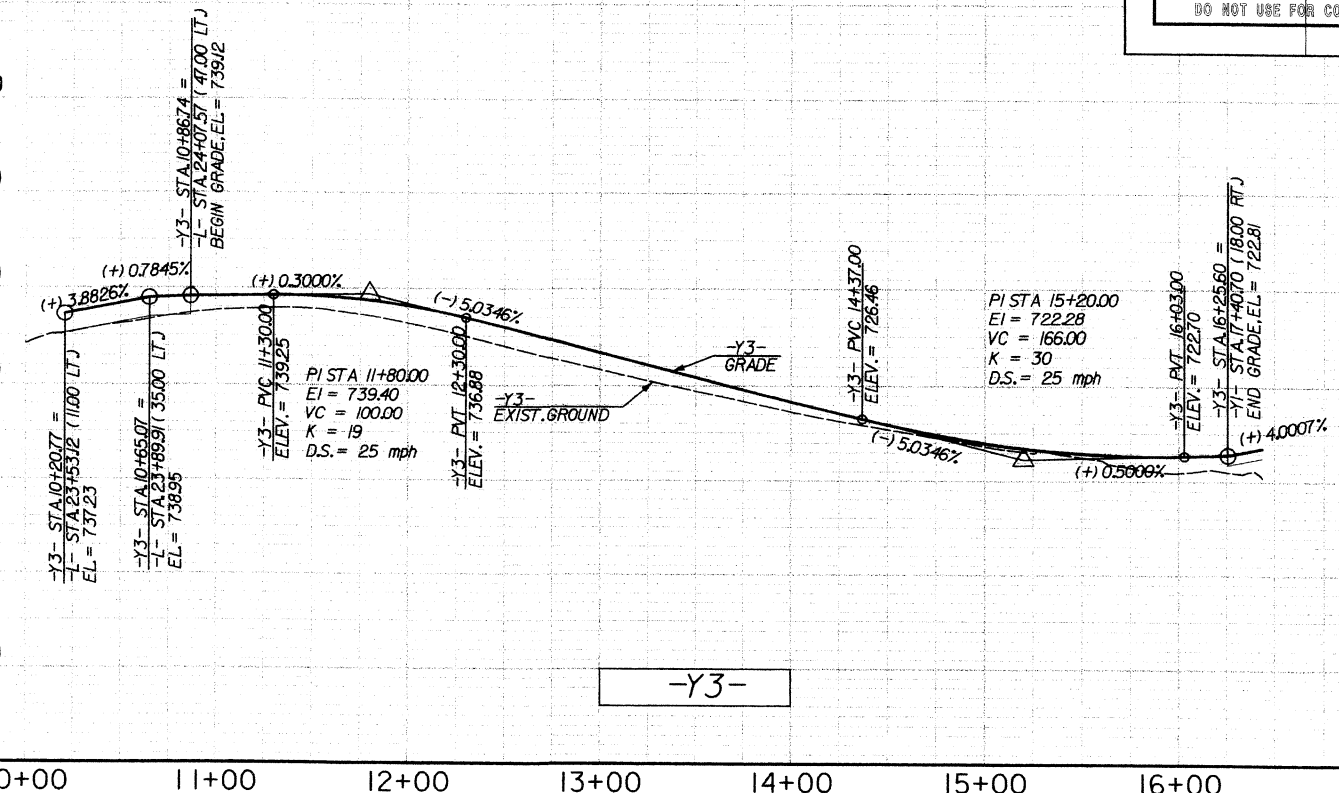
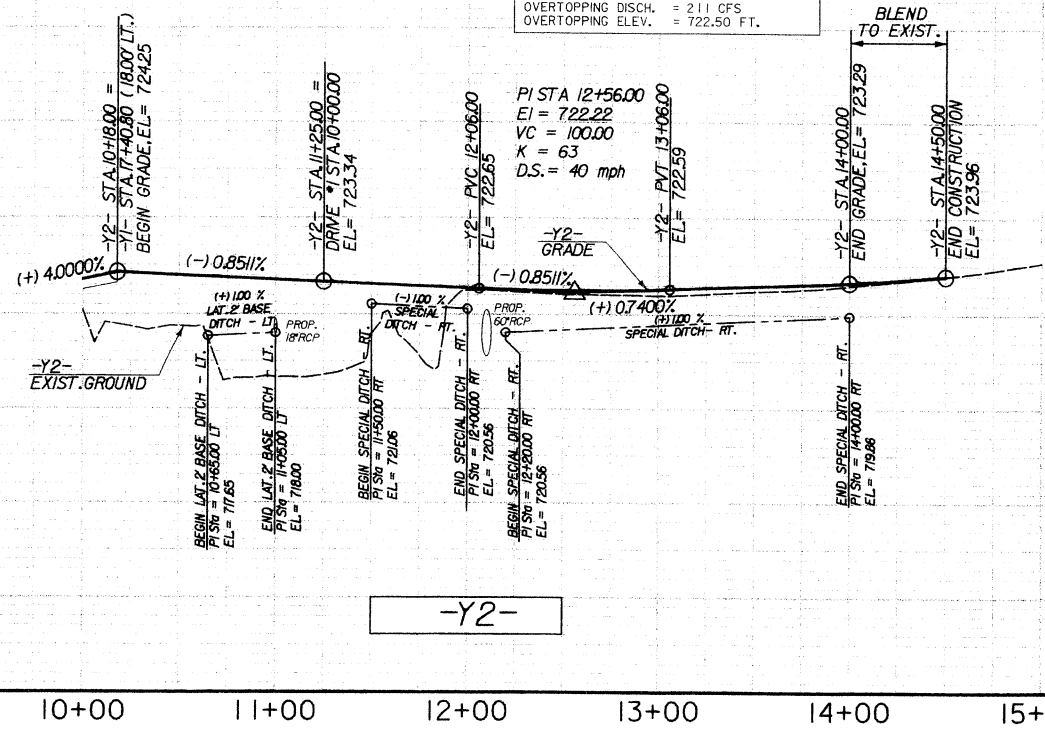
REVISIONS



-Y2- STA. 11+00
PROP. 18" RCP
DRAINAGE AREA = 1.6 AC
DESIGN FREQUENCY = 25 YRS
DESIGN DISCHARGE = 5.94 CFS
DESIGN HW ELEV. = 721.4 FT
100 YEAR DISCHARGE = 6.95 CFS
100 YEAR HW ELEV. = 721.8 FT
OVERTOPPING FREQUENCY = 500 YRS.
OVERTOPPING DISCH. = 15 CFS
OVERTOPPING ELEV. = 723.51 FT.

-Y2- STA. 12+10
PROP. 60" RCP
DRAINAGE AREA = 175 AC
DESIGN FREQUENCY = 25 YRS
DESIGN DISCHARGE = 500 CFS
DESIGN HW ELEV. = 723.35 FT
100 YEAR DISCHARGE = 650 CFS
100 YEAR HW ELEV. = 723.52 FT
OVERTOPPING FREQUENCY = 2 YRS.
OVERTOPPING DISCH. = 211 CFS
OVERTOPPING ELEV. = 722.50 FT.

BM#52
-Y2- STA. 15+59.02, 27.89 LT.
RAILROAD SPIKE IN 24" OAK
ELEV. = 731.07'



REVISIONS

REVISIONS

